VOL. XI, NO. 3. 20TH SEPTEMBER, 1915.

New Zealand Department of Agriculture,
Industries, and Commerce.

THE

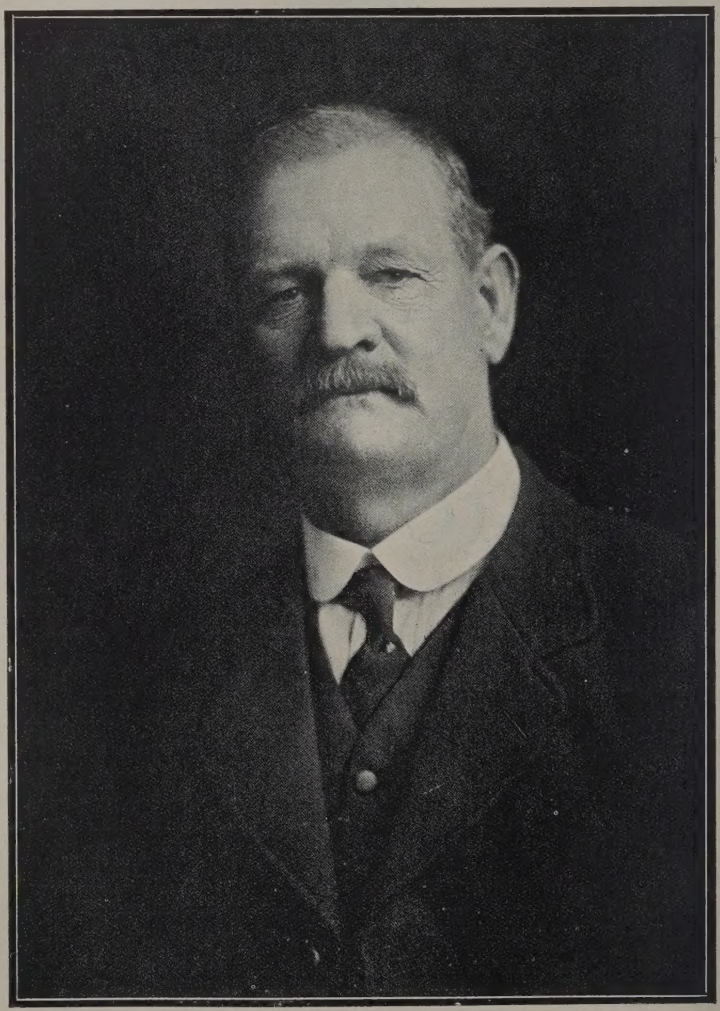
JOURNAL

OF

AGRICULTURE.

Published by direction of
The Hon. W. D. S. MACDONALD,
Minister of Agriculture.

WELLINGTON.
BY AUTHORITY: JOHN MACKAY, GOVERNMENT PRINTER.
—
1915.



HON. W. D. S. MACDONALD,
Minister of Agriculture in the National Government.

The

Journal of Agriculture.

WELLINGTON, NEW ZEALAND.

20TH SEPTEMBER, 1915.

BEEF PRODUCTION.

J. L. BRUCE.

AT no period since the inception of commercial refrigeration has the question of the world's meat-supplies demanded the attention of meat producing and exporting countries more than at the present time. While consumption is steadily increasing, supplies are relatively diminishing by failing to keep pace with the demand. The inevitable result is increased and increasing prices. These conditions apply with particular force to the beef-supply. New Zealand has contributed in a striking degree towards the supply of mutton and lamb, our exports of these staples having steadily increased since the inauguration of the trade from 30,488 carcases in 1882 to 6,436,214 carcases in 1914. Beef, however, has occupied a comparatively minor position in our meat-production, although the New Zealand prime article has been long and favourably known on the London market. It is true that in 1914 the quantity of beef exported from the Dominion amounted to the substantial weight of 30,650

tons, but this output may be said to largely represent a special clearance induced by the extraordinary war demand and high prices, and included a large proportion of secondary stuff. There is reason to believe that the number of beef-cattle proper in the Dominion is at present not more than stationary.

In view of the position as above outlined, the question naturally presents itself whether there is not room in the Dominion for a greater development of true beef-raising on up-to-date lines. In determining the question consideration must also be given to the ever-expanding dairy industry, which absorbs and thrives on fattening-country, and has attained an annual export of 65,000 tons of butter and cheese, with further increases close ahead. Hitherto it has been generally accepted that with the sheep and dairy industries so largely claiming the field New Zealand was unlikely to develop further to any extent as a beef-raising country. This view was mainly held for the reason that sheep and dairy farming were more profitable. The question of profit is undoubtedly the determining factor in all commercial undertakings, and unless good prospects can be shown of beef-cattle raising and fattening becoming permanently more profitable than in past years its expansion to any marked extent is unlikely. The present article advances the view that in consideration of increasing prices and the results to be derived from improved breeding and feeding there exists sufficient inducement to warrant the more vigorous encouragement of beef-producing cattle.

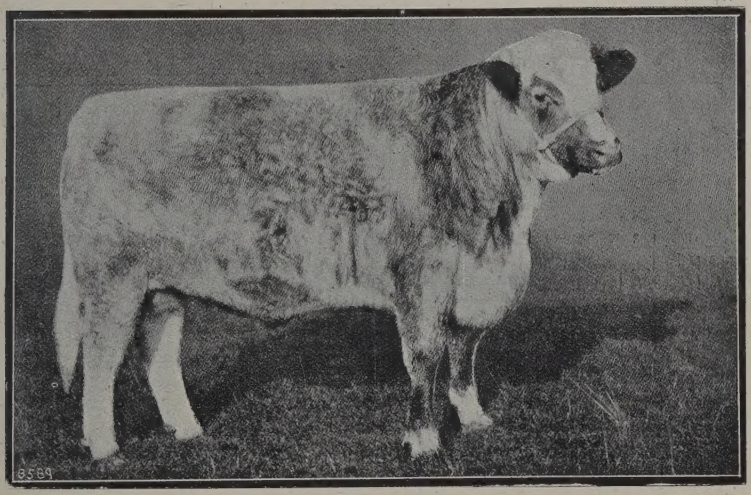
LEADING BEEF BREEDS.

The first essential for the attainment of the object indicated is to commence on sound lines by the further introduction or development of the most suitable and best possible breeds of purebred cattle. Some note and comment in connection with the leading beef breeds of chief interest will therefore not be out of place.

The Shorthorn is essentially a beef-producer, and to be worthy of the name it must have all the attributes of a "butcher's beast." The late Mr. Cruickshank, of Sittyton, Aberdeenshire, who did so much towards the improvement of this breed of cattle, catered at first for the tenant farmers round him, whose sole purpose was to breed and fatten beef-cattle to the highest possible standard of perfection. The Sittyton herd largely laid the foundation of most of the now famous Aberdeenshire Shorthorn herds so much sought after in all the principal cattle-breeding countries of the world.

Perhaps at no previous time has the necessity for improving the Shorthorn in New Zealand been greater than at present, and unless steps are taken to counteract the defects manifested from a beef-

producing standpoint this fine breed must take a second or third place as beef-cattle in the Dominion. Shorthorn-breeders should recognize that there are at least two powerful rivals in the field, the Aberdeen-Angus and the Hereford; and if the "king of cattle,"—as some hold the Shorthorn to be—is to retain his place in this country the sooner greater activity is shown in importing young bulls of the best strains of beef-producing Shorthorns the better it will be for all concerned. Either the beautifully finished, fine-quality, well-fleshed, and attractive Irish Shorthorn, or the somewhat heavier, robust, and strong-constitutioned Aberdeenshire strains are considered to be eminently suited for our New Zealand herds. Possibly the finest Shorthorn bull in the Dominion to-day is an imported animal



SHORTHORN STEER.

Age, one year nine months; weight, 1,487 lb. Champion beast at the Norwich Fat Stock Show, 1914.

from the North of Ireland. The extra-heavy Shorthorn is not so well adapted to this country, where cattle have often to "fossick" for their food, as the more compact high-quality and early-maturing animal.

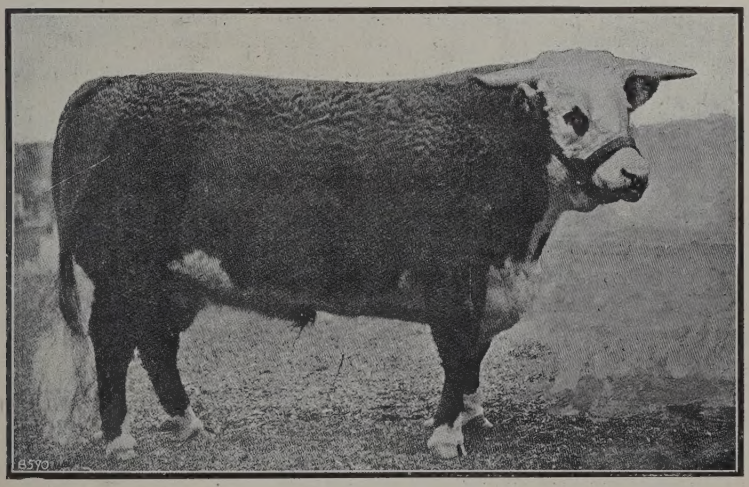
In any case the day of the heavy four- or five-year-old bullock weighing 1,200 lb. and over is, or should be, past. The aim should be a type of Shorthorn whose progeny will grow rapidly, mature early, and give the highest quality of beef with low percentage of offal. A 700 lb. carcase at two years old will pay better than keeping animals to three and four years old for the increased weight. It is the best return per acre, and not the weight per

head of fat stock, which the farmer has to consider, and selection should be made accordingly. Instances are on record of Shorthorn carcases yielding over 70 per cent. dressed carcase to live weight—indicating both quality and early maturity. Perhaps the most valuable attribute of the Shorthorn for all-round purposes is its suitability for crossing with other breeds. No other breed of cattle, unless perhaps the Aberdeen-Angus, can stamp itself upon inferior breeds and improve them in the same degree as a real "top-notch" improved Shorthorn bull.

The Hereford.—For consistency in breeding true to type the improved Hereford stands alone, a sure indication of its long-established ancestry. Although keen rivalry exists between breeders as to the superiority of one breed of beef-cattle over another, few will dispute that the improved Hereford as a grazier's beast possesses within itself all the main qualities essential to beef-producing cattle. As a forager on broken pastoral land the Hereford is unsurpassed, and, such conditions being common in this country, the breed is destined to hold a front rank in our purebred beef-producing cattle. For crossing purposes the Hereford has not been so largely used as some other breeds, owing no doubt to the completeness of its characteristics. In consideration of its merit as a commercial beef-producer, coupled with its singular qualities for grazing purposes, it is questionable whether the maintenance of the purebred Hereford should not be advocated in preference to crossing. For constitution and endurance under adverse climatic and feed conditions the Hereford is remarkable. In Otago and Southland in the early spring, after fairly severe winters the writer has frequently observed that when other breeds of cattle were showing signs of having undergone a hard season the Herefords usually remained sleek and fit. Notwithstanding the many fine qualities of this noble breed of cattle, it is remarkable how seldom the Hereford has been successful in winning the highest honours at the Smithfield Club Show. Nevertheless the Hereford is a great commercial animal and admirably suited for the pastoral areas of New Zealand.

The Aberdeen-Angus.—This fine breed of beef-producing cattle is native to the north-east of Scotland, and is undoubtedly of great antiquity. Early in the sixteenth century the Black Hummel breed held a prominent place in Aberdeenshire as commercial cattle. Through the intervening centuries it seems to have retained comparative purity until its establishment as a pure breed over a century ago. The Aberdeen-Angus as an improved breed dates from about the end of the eighteenth century, and from then it continued to make progress in popularity even against its great rival the Shorthorn. Shorthorns at this date were attaining great favour and being readily purchased at prices hitherto unknown for

any breed of cattle, Colling Brothers' roan Shorthorn bull "Comet" having brought a thousand guineas in 1810. The rivalry between these two famous breeds for the first place as beef-producing cattle has continued for over a century, and the issue is still undecided, the advocates for each claiming a superiority over the other. One point, however, is unlikely to be disputed—that is, a century of healthy rivalry has done much towards making each breed what it is to-day. To William McCombie, of Tillyfour, and Sir George Macpherson Grant, of Ballindalloch, Aberdeenshire, must the credit be largely given for the enviable position held by the Aberdeen-Angus breed of cattle throughout the world to-day. Their successes



HEREFORD STEER.

Age, two years ten months; weight, 2,068 lb. Champion beast at the Birmingham Fat Stock Show, 1914.

at early French International Exhibitions as fat stock and breeding-cattle also gave the Aberdeen-Angus an impetus which it has maintained for the last half-century. As a beef-producer from the commercial standpoint the Aberdeen-Angus holds a first place—if not with all graziers, it certainly does with the butcher. This breed holds the record with over 76 per cent. dressed carcase to live weight, and at both the Smithfield Show and the International Fat Stock Show, Chicago, the Aberdeen-Angus—either the purebred or its crosses—for many years past has won more championships than any other breed of cattle. For early maturity the Aberdeen-Angus has much to recommend it. Perfection in anything is difficult

to find, but were it not for its temperamental weakness so well known to all experienced stockmen the Aberdeen-Angus would, in the writer's opinion, come very near to being the perfect beef-producing animal.

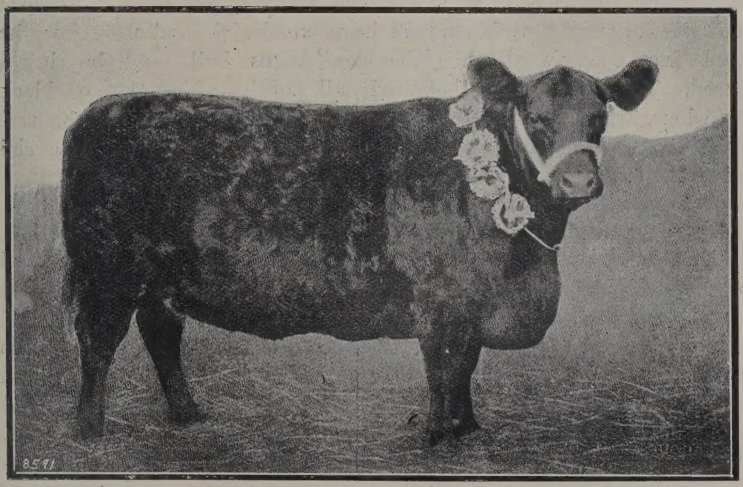
The Devon is an ancient breed of cattle dating back several centuries without showing any marked variation in type, and, as indicated by the name, is generally believed to have had its origin in that county. Devon cattle are now widely distributed, and readily adapt themselves to local climatic conditions different from their original habitat. Whatever its origin may have been, the Devon under all conditions shows a decidedly well-fixed type with strongly defined breed-characteristics. Although some strains vary somewhat in shade, the deep red is the dominating and popular colour. When the Devon is crossed with the Hereford, Aberdeen-Angus, or the Shorthorn bull some marvellous beef carcases are obtained.

DUAL- AND SINGLE-PURPOSE BREEDING.

The expansion of the sheep industry is unlikely to affect the development of beef-raising in New Zealand, but with the dairy industry the case is different. To many experienced stock-breeders the problem presents itself: Can we breed for both beef and milk; can high-class beef-producing cattle be obtained from purebred or crossbred cows which are capable of supplying milk equal to or in excess of that of an average cow in a good dairy herd? If so, is it practicable to attempt both the production of milk and the raising of beef-cattle from the same stock? As a general rule it may be found the safer policy to pursue a single purpose—either the production of butter-fat or beef, the determining factors being expediency and the highest net return per acre.

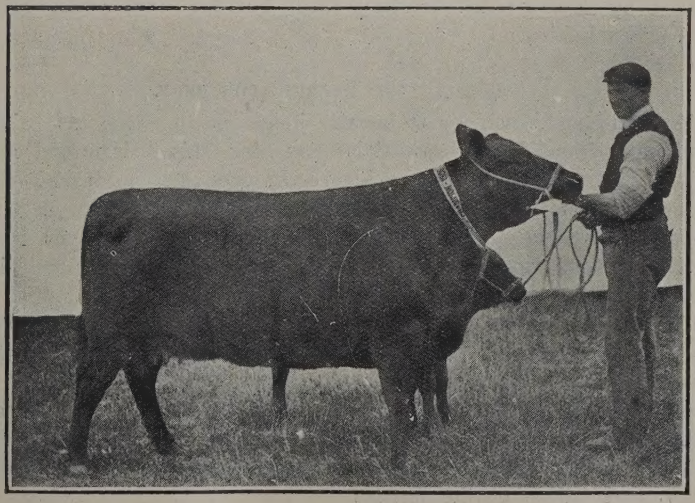
CROSS-BREEDING FOR BEEF.

It may be asked why, with such excellent purebred cattle for beef-producing purposes, cross-breeding should be recommended. For stud purposes no animal can be too pure; all purebred stock should be raised to and maintained at its highest possible perfection. For commercial beef-producing purposes, however, it has been found that the crossing of some breeds gives better results than the purebred on either side. First among these crosses is that of the Aberdeen-Angus bull with the Shorthorn cow. The carcase from this cross is so famous in the meat-markets of the world that it need not be dwelt upon here. The cross of the Aberdeen-Angus bull with the Hereford cow, as with the Shorthorn, gives a carcase superior to either of its component purebreds in both weight and quality. The Devon also crosses well with the Shorthorn bull.



ABERDEEN-ANGUS HEIFER ESTELLE OF MAISEMORE.

Age, two years eight months; weight, 1,670 lb. Champion beast at the Smithfield Club Show, London, 1914.



FLOWER, A NEW-ZEALAND-BRED ABERDEEN-ANGUS.

For bringing back a herd of deteriorating station cattle composed mainly of the Shorthorn strain the introduction of a Shorthorn bull of the very best blood will have wonderful results. After the herd has recuperated the Aberdeen-Angus bull may be introduced. The progeny will be nearly all hornless, blue-roan or black in colour, with flesh evenly distributed, true butchers' beasts, and attaining the objective—a healthy, hardy, and profitable commercial ox or heifer.

THE BREEDS AND THE BUTCHER.

The chief features from a butcher's standpoint of the several breeds dealt with may be here mentioned. The Shorthorn when fat gives a carcase well filled in every respect, showing a splendid thick loin and ribs, deep heavy brisket and flank, and opens up excellently so far as internal fat is concerned. The Hereford produces beef of fine quality, although large in size for weight of carcase compared with the Shorthorn or Aberdeen-Angus. The Hereford gives a splendid back and well-set ribs, but the hind quarters from the hock to the rump show a falling-away or want of fullness, which largely accounts for the somewhat lighter weight of carcase in proportion to its size. The Aberdeen-Angus has strong claims for the premier position, being a compact, heavy-weighing, and fine-quality beef-producer. For percentage of dead-weight of carcase compared to live weight, as already mentioned, it holds the record. For veal the male calves of the Channel Islands and other light breeds of dairy cattle may be profitably utilized by forcing with artificial food, but are not recommended for beef-production.

MANAGEMENT AND REARING FOR BEEF.

The farmer himself must be the judge as to when his calves should be dropped, the essentials governing this being food and shelter. The proper aim is rapid growth and early maturity. To accomplish this the calf should at no time be allowed to have a set-back; its development should be gradual and continuous from birth onwards. The question of rearing calves by natural or artificial means—whether the calf is to suckle its dam or to be hand-fed—is also a matter for the farmer to decide. If hand-fed, those interested are referred to an article in the July, 1914, issue of the *Journal* dealing with the rearing of calves. Whichever method is adopted, great care should be exercised at weaning-time. A check at this time may delay maturity for several months, and may be the determining factor between profit and loss, or between the success and failure of the farmer.

With suckled calves a good plan is to erect several weeks before weaning-time, in the paddock where the cows are running, a small enclosure with a gateway wide enough and high enough for the calves to enter, but too low and too narrow to admit the cows. Here the calves can be fed with half-ripe oaten sheaves containing a mixture of peas and tares similar to that so profitably used for milking-cows by some of our leading dairymen. It costs very little to put in a few acres of these forage crops. Tares and oats are better put in in three sowings—early, medium, and late—in areas suitable for requirements. In the enclosure the calves can also be taught to eat turnips, and be given a fairly liberal allowance of crushed oats to complete the ration. Some may hold that this is sheer extravagance, with oats at over 3s. 6d. per bushel. Granted this is an exceptional year, and oats much above normal value; nevertheless, try the plan, and, taking one year with another, it will pay. The farmer who so arranges that the produce of his farm walks away upon four legs is generally on good terms with his banker through having a comfortable credit balance. The ration for hand-fed calves should be the same as for suckled calves.

The winter over, with the yearlings still retaining their "calf beef."—a very important point in the raising of beef-cattle—they will continue to thrive and develop during the summer on good young grass. The beasts are then ready for finishing off in the autumn with a couple of months or more on the previous season's ration, and can be marketed as "prime fat" from about twenty-two months old.

To those who may hold that at least six months' longer keeping would pay, it is suggested that animals so held should be well wintered in order that condition be fully maintained, and fattened off the grass the following season. No doubt this method would give a nice beef-animal. If the earlier-dropped calves were fattened under the first-mentioned system, the later calves would come in very well under the latter one.

Such a rapid change from our fine big bullocks of mature age to prime and well-developed animals of early maturity may seem too sudden for some, nevertheless it is coming. It is, of course, not held that the raising and fattening of beef-cattle can be revolutionized in a short period; the system outlined above is an ideal to endeavour to work up to where conditions will permit. It is well known that there are great areas in New Zealand where cattle-feeding on the above lines is impracticable. Nevertheless, on any class of country the aim should always be the best in breed, health, and condition, with the largest possible net profit per acre.

A MARKETING CAUTION.

A word of caution may be given to the farmer who has not had previous experience in marketing the class of beef-cattle reared on the improved lines described. At first he will be unlikely to make proper allowance for the increased value of such high-quality meat —quality which the butcher and his customers will not be slow in discovering—nor is he likely to realize the proportionately increased dressed weight of his fat beasts. Such animals kill much better and weigh heavier than those which have undergone the many vicissitudes of long lives. How meat which is so carefully weighed by the carcase and again retailed to the consumer to the half-ounce can continue to be sold on its foot from the top of a saleyard rail, the buyers looking down on animals with only backs and horns visible, has been a wonder to the writer for many years. No doubt there is some explanation, but in most other countries stock is sold by live weight, and the man who produces quality receives the full benefit.

CONCLUSION.

As indicated in the first part of this article, it may reasonably be assumed that beef-cattle will increase in value for years to come. There is therefore strong ground for stimulating a development of beef-raising proper in the Dominion. New Zealand holds first place as a producer of mutton and lamb amongst all the countries catering for the world's meat-markets. With as fine a soil and climate as any under the sun, we who can produce the best of mutton and lamb can, if we apply the same thought and care, produce also as a staple the best of beef. Now is our opportunity.

HEREFORDS IN NEW ZEALAND.

PRESERVATIVE TREATMENT OF FARM TIMBERS.

E. PHILLIPS TURNER.

UNTIL recent years there has been such an abundance of durable native timbers in New Zealand that they have been used with the utmost disregard for economy. It was probably true economy to utilize as soon as possible all milling-timbers that were growing on lands rich enough to be used for dairying or fattening purposes; but it was decidedly a mistake to hasten the utilization of valuable timbers, such as kauri, matai, and totara, when growing on poor lands. The very extravagant use of our valuable timbers in the past has reduced the Dominion's store to such an extent that in about thirty years' time we shall probably be dependent on outside supplies—at prices corresponding to a world demand. With such a prospect, then, it is of the greatest importance that we use our present stock of native timbers with the strictest economy.

INFERIOR NATIVE TIMBERS WILL SOON BE VALUABLE.

At the present time the various beeches (the settlers' "birches"), tawa, taraire, and kamahi are almost entirely neglected, yet it is certain that the time is close at hand when these timbers will be used. For purposes requiring durability they may have to be treated with preservative; but for fruit-cases and cheese-crates there is no reason why red and silver beech (birch) and kamahi should not be used at the present time without any preservative treatment; in fact, they should be good enough untreated for weatherboards, as the tendency to warp and shrink is not worse with them than it is with the timber gum-trees of Tasmania. Timber from one or other of the gum-trees (generally stringy-bark or swamp-gum) is the only timber used in house-building and for all the fruit-cases made in Tasmania. Forests, then, that contain the beeches in large quantity are even now valuable, and they should be strictly looked after and protected from fire.

GROWING DURABLE TIMBER FOR FARM PURPOSES.

As a rule the timber of the Australian gum-trees is not durable when obtained from young trees; and in some localities in New

Zealand severe climatic conditions prohibit the successful growing of those varieties that do produce durable timber when young. The black locust (*Robinia*) is an undoubtedly durable timber at an early age, but many object to it on account of its habit of sending up suckers, and also on account of its extreme hardness making it a difficult matter to drive staples into seasoned posts. In America it is now considered more profitable to grow a tree that produces an inferior timber rapidly—*e.g.*, willows and cotton-wood (*Populus deltoides*)—and to make the timber durable by antiseptic treatment.

PRESERVATIVE TREATMENT OF TIMBERS.

The antiseptic treatment of timbers has been in practice in Europe and America for a considerable number of years, and its efficacy is beyond dispute. Thinnings from plantations that are used for mine-props or for farm purposes, and railway-sleepers, are treated with creosote* before being used for their respective purposes. Were it not, in fact, for the great additional life thus given to young timber, the thinnings from European artificial forests would not return sufficient to pay the cost of the operation of thinning.

There are several processes for the preservation of timber, the chief of which are (1) the forced injection into the wood of zinc chloride, creosote, or a compound of which creosote is the main constituent, and (2) the simple immersion of the timber in a heated solution of one or other of the preservatives used. In some cases where the timber used does not come in contact with the ground and is not exposed to the action of weather the simple application of creosote or creosote compound with a brush has been found to be efficacious. Where this can be done the cost of treatment is, of course, very much lessened. Timber treated in any way with creosote is turned a brown colour, and it will not take paint readily.

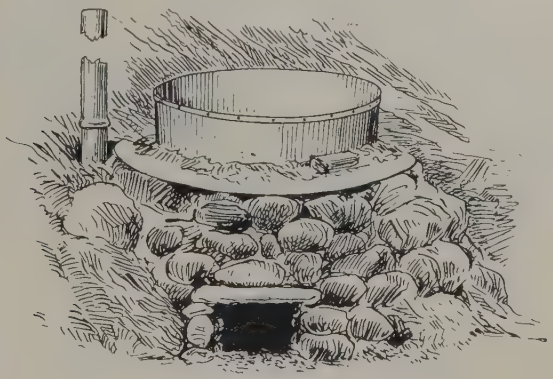
Mr. Orton Bradley, of Banks Peninsula, has found that by simply immersing *Pinus radiata* posts in hot coal-tar they can be given a life equal to that of our ordinary fencing-timbers.

PLANT REQUIRED AND PROCESS.

On small properties it will not, of course, pay to go in for a large plant. For treating those timbers which are non-durable only when in contact with the ground (*e.g.*, kauri posts, black-pine posts, and posts from some of the gum-trees), an iron boiler

* Ordinary commercial creosote is one of the by-products of coal-tar.

3 ft. in diameter and 4 ft. deep, set in a bank, as roughly shown in the accompanying sketch, is sufficient. A firebox and a hot-air chamber are constructed with brick, stone, or stiff clay. A sheet-iron collar may be added to cap the built-up part, and the boiler is supported by a strong foundation. The creosote is poured into the boiler and heated to about 220° F., and the butts of the posts are put into the preservative to a depth about 6 in. above that to which they are to be put into the ground, and are allowed to remain until they are saturated. Care must be taken to see that the creosote does not catch fire.

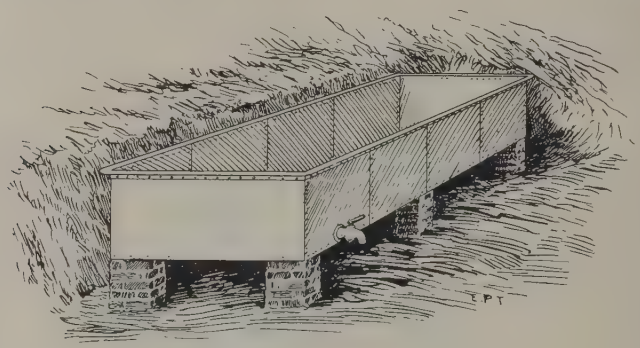


BOILER FOR TREATING BUTTS OF TIMBERS.

The treatment can be rendered still more efficacious if the posts be afterwards painted with creosote or wholly immersed in a tank containing creosote just sufficiently warm to be quite liquid. This tank should be made a little longer than the post, and should be large enough to hold double the number of posts that the heating-tank does; it should also be deeper than it is wide, in order that the exposed surface of the creosote may be as small as is consistent with convenience, for the larger the surface the greater will be the loss by evaporation of the warmed creosote.

In treating timbers that naturally perish quickly, such as willow, poplar, young pine-trees, wattles, and several of our common native timbers, it is essential that the whole post be immersed in the liquid preservative heated to about 220° F. For this purpose it is necessary to have a heating-tank long enough to receive easily the whole post, as shown in the second sketch. The tank should be placed on piers and be situated at the foot of sloping ground in order to facilitate the putting-in of

the timber. The situation should be protected from the wind, and the piers should be high enough to permit the making of a fire beneath the tank. To prevent the possibility of the timber being charred, a perforated-iron false bottom should be put inside the tank. Close to this tank there should also be another tank (containing creosote just sufficiently heated to keep it liquid) in which the timber is put for its final treatment. The time required



HEATING-TANK FOR IMMERSING TIMBERS.

for immersion varies with different timbers, but it will be found that, as a rule, six hours in the hot creosote and eight hours in the cold creosote is sufficient.

AMOUNT OF PRESERVATIVE REQUIRED BY TIMBERS.

In timber-preservation all that is necessary is that the *walls* of the cells of the wood should be coated with the antiseptic; if the cells themselves are filled with the antiseptic there is a waste of material and an increase in the cost. The absorptive capacities of timbers differ very much; a Scots pine post 5 ft. by 6 in. by 4 in. will absorb 1½ gallons of creosote; a European-larch post about ⅓ gallon, an Oregon-pine post about ½ gallon, a Corsican-pine post about 2½ gallons, and an Austrian-pine post about 2¼ gallons—all being of the size above specified. An American-cottonwood 6-in.-diameter round post absorbs $\frac{7}{10}$ gallon. Immersed in hot tar a *Pinus radiata* post 6 in. in diameter will absorb (if saturated) about 2½ gallons.

The heart-wood of nearly all timbers takes creosote with difficulty; for this reason with timbers of which the heart-wood is not naturally durable it is better to have round posts cut from small trees, so that the heart-wood is surrounded by a

cylinder of sap-wood that will readily absorb the preservative. In California and South Australia experiments have been made in the treatment of the various eucalypts with creosote, but the results have not yet been published.

It has been found that in many cases timbers absorb a great deal more creosote than is necessary for their preservation; and, bearing this in mind, several persons have adopted a plan of combining a less expensive material with the creosote. Professor Annand, of Newcastle-on-Tyne, has found that by adding ¼ per cent. of caustic soda to creosote it can be diluted to any extent with water; and that creosote to which ¼ per cent. of caustic soda has been added and afterwards diluted with 50 per cent. of water will in all cases penetrate the wood as far as, and in some cases even more than, the pure creosote. The immersion given was eight hours in hot solution and thirty-six hours in cold solution. It will be seen that by this means the amount of creosote used is reduced about 50 per cent.

It must be borne in mind that before treatment the timber must be seasoned; also the bark must be taken off, as it prevents the timber being penetrated by the creosote, and by absorbing it causes waste. After being taken out of the tank the posts should be stood on sheets of corrugated iron to drain, and the creosote that runs off should be led into an empty drum. Care must be taken that the creosote does not catch fire; its temperature should not be more than about 220° F., as, if more, the wood is liable to be detrimentally affected; moreover, there would be considerable loss of creosote from evaporation.

Creosote is a material of variable composition, and its efficacy as a timber-preservative is dependent mainly on the presence in it of a large proportion of oils the boiling-point of which is not less than 480° F. In buying creosote, then, one must make sure that it is of standard quality.

Zinc chloride is much used in both Europe and America, but as this salt is easily soluble in water it is liable to be washed out of timber that is put in the ground. To obviate this drawback, however, the Indian Government is trying the experiment of painting over with green oil (a derivative from creosote) sleepers that have been treated with zinc chloride.

COST OF TREATMENT.

Before the present war creosote could be landed in Wellington at about 10¾d. per gallon, though the price in England was only 4d. to 5d. It is, however, a kind of cargo on which the freight is heavy. Since the war began the price has risen considerably,

and outside supplies are difficult to procure. It is understood, however, that the local market will shortly be tested by a New-Zealand-manufactured article at a very moderate price. Supposing that on the farm the creosote has cost 9d. a gallon, and that the saponified process (adding ¼ per cent. of caustic soda and diluting with 50 per cent. of water) be adopted, then a larch post will require ⅛ gallon of creosote, costing about 1½d.; a poplar post will require $\frac{7}{20}$ gallon, costing about 3¼d.; a willow post will require $\frac{6}{20}$ gallon, costing about 2¾d.; a *Pinus radiata* post will require about 1⅛ gallons (based on its absorption of tar), costing 1s. Using *pure* creosote the cost would be double the above. In the case of the *Pinus radiata* posts treated with tar it must be stated that all the cells were filled: the post thus absorbed about *double* the quantity necessary for its preservation.

The cost of commercial zinc chloride, if imported to New Zealand (at present only the refined material for medicinal purposes is imported), would be about £1 10s. per hundredweight. A solution of 1 in 50 is generally used, so with a liquid of this strength the cost of the preservative absorbed would be only about one-sixth of the cost of the creosote that would be absorbed by the method described above. As it is desirable that the butts and the tops of the posts should afterwards be painted with creosote, another 1d. per post might be added to the cost of the preservative materials.

In the foregoing the labour and the cost of the tank are not considered; the man doing the treating could also be doing some other work at the same time, and if the tank were under a shed the treatment could be done on wet days. The cost of the two tanks should not exceed £15, which, spread over a number of years, would not amount to much per post treated. If an old engine-boiler be used the cost would be less. The cost of the small boiler suitable for treating the butts only of the posts would not be more than about £2, and as it could be used for other purposes all this cost would not be chargeable against the treatment.

CONCLUSION.

When it is considered that any perishable timber by the treatments described can be given a life of *twenty* years, I think that in those districts where durable fencing-timbers are scarce it will safely pay to adopt antiseptic treatment of any timbers that are available. The treatment would be of special advantage to those farmers who have on their properties an abundance of willows or poplars; and as these trees are particularly rapid growers in their early years it would often pay to grow them for posts to be treated with a preservative.

CLUB-ROOT.

A. H. COCKAYNE.

In New Zealand the growing of root and forage crops belonging to the cruciferous or turnip family is of such importance that the diseases affecting them are rightly looked upon as amongst the most serious against which the farmer has to contend. Not the least dangerous of the many diseases that affect the various field and garden members of the turnip family is that one generally known under the name of club-root. During the past season club-root has been extremely prevalent in various parts of the Dominion, and especially serious amongst swede crops. As this disease is extremely liable to spread rapidly over extensive areas, and as its presence seriously interferes with the successful production of turnips, swedes, and rape, the adoption of measures likely to restrict its distribution is much to be desired.

APPEARANCE OF THE DISEASE.

Infected young plants show irregular thickenings and swollen outgrowths on their roots. These swellings often increase enormously in size and completely deform the underground portions of the affected plants. Owing to the fantastic shapes often assumed by the diseased swellings, various names have been applied to the disease, such as finger-and-toe, anbury, and canker, but club-root is the most widely used of the popular names. In cases of severe attack the aerial portions of the affected plants, having much of their water-supply cut off, rapidly wilt, and the "clubbed" portions of the roots soon rot, so that finally the plant dies before reaching maturity. In cases of mild attack quite a fair crop may be produced, but many of the roots will show the characteristic swellings. Under such circumstances the farmer is apt to think that but little damage has been done. He loses sight of the fact, however, that even a small percentage of affected plants is sufficient to thoroughly infect the ground and make it quite unsafe for swede or turnip growing for several years. Besides this, the presence of a small infected area often results in the whole of the farm becoming contaminated unless rigid precautions are taken to localize the outbreak.

CAUSE OF THE DISEASE.

The organism causing the disease is not a true fungus, but is placed in a separate group known as "the slime fungi." This group of extremely lowly organized life possesses certain characters that superficially resemble those characteristic of the true fungi. On the other hand, many of the features of their life-history so closely approximate to those of certain of the lower animals that biologists are even yet in doubt as to which great kingdom of organisms—plant or animal—the slime fungi should be classed in.

CLUB-ROOT IN CABBAGE.—ADVANCED STAGE OF DISEASE.

The life-history of club-root was first described by the Russian plant pathologist Worcnin in the year 1878, and he named the causative organism *Plasmodiophora brassicae*. On examining an affected but not yet decayed root many large cells will be seen containing a brownish mass of semi-fluid consistency. These masses, which are not enclosed by any special envelope, are capable of movement, and assume various shapes. They feed on the food

materials elaborated by the plant, and their presence causes a great development of abnormal tissue that results in the knots and swellings so characteristic of the disease. After a certain time the brownish semi-fluid mass (called a "plasmodium") within the giant cells breaks up into an immense number of spherical spores each encased in a thick protective envelope. The diseased portions now rot away, and the spores are liberated in the soil. After a period of rest the wall of the spore splits, and a naked mass of protoplasm emerges and swims about in the soil-water. This mass of protoplasm, termed a "swarm-spore," is apparently able to penetrate the more delicate parts of the root, probably by way of the root-hairs, and finally comes to rest in a normal cell. Enlargement of the invaded root then occurs. It is thus seen that in order for a crop to become infected it is necessary for spores to be present in the ground. These spores are apparently capable of retaining their vitality for many years.

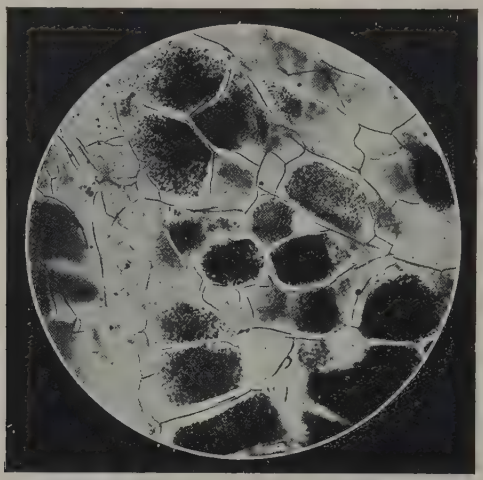
PLANTS AFFECTED.

Club-root attacks only plants belonging to the turnip family (*Cruciferae*), and in New Zealand has been reported as occurring on the following cultivated members of the group: cabbage, cauliflower, Brussels sprouts, rape, mustard, swede turnip, soft turnip, radish, and wallflower. The disease is also often found on the roots of certain weeds belonging to the same family, amongst which may be especially mentioned Shepherd's purse (*Capsella bursa-pastoris*), wild turnip (*Brassica campestris*), American cress (*Barbarea praecox*), hedge-mustard (*Sisymbrium officinale*), and pepperwort (*Lepidium niderale*). It is probable that certain other cruciferous weeds assist in the perpetuation of the disease in New Zealand.

DISTRIBUTION IN NEW ZEALAND.

Club-root is widely distributed, and has been found in all classes of soils in New Zealand. It is, however, most prevalent on the west coast of the North Island, and especially in the Taranaki and north Wellington districts. In the South Island it is comparatively rare as a field-crop disease, but is often abundant in garden soils. Those districts in which the underlying rock is largely composed of limestone generally are comparatively free from the disease, but at certain times bad outbreaks occur in such localities. In such cases it is probable that although the subsoil is largely of a calcareous nature the upper layers are really deficient in lime, owing to it having been leached out in the ordinary processes of weathering. Again, soils overlying the marls (papa) are frequently

subject to attack; here also the upper layers of the soil are apparently generally acid and their lime-content low. It is, however, notable that on the acid volcanic soils of the north club-root has never become troublesome, while on the basic volcanic soils in the vicinity of Auckland the disease is quite prevalent. In general, sandy soils appear to be less subject to attack than those of a clay nature, but many exceptions have occurred, so that it appears impossible to frame any generalizations as to the types of New Zealand soils that are not subject to this disease.



CLUB-ROOT.—DISEASED CELLS FILLED WITH CLUB-ROOT SPORES. X 250.

THE EFFECT OF ACID SOILS.

A very noticeable feature with regard to club-root is the fact that its prevalence as a serious disease did not take place in Europe until the modern use of artificial fertilizers became general. Since that period it has been abundantly proved that the use of artificial manures of an acid nature increases the ravages of club-root. It has been shown that acid-soil conditions are far more favourable for the development of club-root than are those of neutral or alkaline soils. This fact is of the greatest importance, as on it rests the whole principle of controlling club-root by chemical means.

OUTGROWTHS SIMULATING CLUB-ROOT.

The presence of nodular outgrowths and knob-like swellings on the roots of turnips, swedes, and rape is not always due to infection by the club-root disease. In many instances quite healthy plants may exhibit root-malformations, and it becomes necessary to distinguish between these and those actually caused by club-root infection. The only satisfactory way of determining the presence of club-root is by a microscopical examination of the deformations. As this method is generally beyond the reach of the average farmer, cutting across and noting the appearance of the cut surface of a suspected diseased part is the only step for him to take. Tissue affected with club-root when cut across is quite solid, but is mottled with white opaque patches intermingled with others of a creamy or grey colour. If, on the other hand, the cut surface displays a quite uniform colour and texture it is safe to consider that the deformations are not due to club-root. It has recently been shown that cross-fertilization occurring in turnip and allied crops that are grown for seed leads to the production of hybrid offsprings that develop root-malformations. At the present time, indeed, the presence of nodular outgrowths on swedes, turnips, and rape that simulate club-rooted structures, but do not contain the organism, is held to be conclusive proof that the plants are of hybrid origin. (See illustrations on next page.)

Occasionally the roots of cruciferous plants may develop small nodules that never become more than half an inch in diameter. In most cases such outgrowths have been shown to be caused by eelworms, but their presence does not appear to interfere to any great extent with the development of the plants.

METHODS OF CONTROL.

In the control of club-root it is extremely important to note that the contamination of the soil over large areas from comparatively small centres of infection can easily take place. So far as field crops are concerned, these are generally fed off *in situ*, and stock feeding on diseased crops carry away large numbers of the spores on their feet when driven on to fresh fields. As for spores in fæcal matter, it is doubtful if they retain their vitality after passing through an animal. For my part, I am convinced that the greater part of soil-contamination takes place through the stock feeding on diseased crops and being transferred to fresh ground. It would appear to be a good practice to try and limit this method of spread as much as possible, and not to transfer stock that have been feeding on diseased crops to land that will be required for

turnip or swede growing for some years at least. I know that this will not be practicable in many cases, but whenever such a procedure is feasible it should be carried out. Paddocks that have carried a diseased crop should be limed if possible, and if this cannot be done the area should not be sown with a cruciferous crop for at least three years. Any crop that is not a cruciferous one can be grown with perfect safety, so that excluding the growing of the turnip family on affected paddocks need not seriously affect the rotation practised. It has also been shown that affected land

SWEDES SHOWING MALFORMATIONS DUE TO HYBRID ORIGIN OF THE SEED. NOT CLUB-ROOT.

sown to pasture in which clover, especially red clover, plays an important part appears to become free from the disease more quickly than when little clover is used. From this is indicated the fact that leguminous crops should be grown on affected ground.

Liming is universally looked upon as the greatest safeguard that can be secured against the attacks of club-root. Lime in the carbonate state (ground limestone) is now generally preferred to burnt lime, but the dressing necessary for badly affected land is

large, as much as 7 tons per acre having been advocated; smaller amounts of from 1½ to 3 tons, however, have given good results in many parts of the world. It is important to remember that in regions where club-root is prevalent the liming of the ground should be done in the autumn previous to the sowing of the seed; the best results, in fact, have been secured with a heavy liming two seasons before a cruciferous crop was grown. The fact that acid artificial fertilizers appear to greatly increase the development of club-root should not be overlooked, and whenever it is feasible basic manures should be substituted. The effects of basic slag in restraining the excessive development of club-root in many parts of the North Island has been most marked.

COMPARATIVE IMMUNITY AMONG SWEDE VARIETIES.

So far as swedes are concerned, there appears to be a great variation in the comparative immunity of certain varieties over others. It is generally stated that Superlative is almost immune, and certainly many crops of this variety have escaped while others in the immediate vicinity have become seriously affected. Other varieties that often appear to be extremely resistant to attack are Magnum Bonum, John Bull, Elephant, and its close ally Crimson King. But there does not seem to be any variety that is completely immune from attack, and one variety that more or less escapes one season may in the next become seriously affected. This has been particularly noticeable with regard to Superlative; but in this case probably the forms now susceptible are different strains to those previously resistant.

PASTEURIZATION OF WHEY.

For many years past it has been the custom of a large number of the cheese-factories to pasteurize the whey before returning it to the milk-suppliers, with the result that this by-product reached the farm in a very much better condition than formerly. It was also found that the stock to which it was fed thrived much better than upon unpasteurized whey, and the farmers were almost unanimous in their opinion that its value was increased. Moreover, when the whey was pasteurized the surroundings of the whey-tank at the factory were free from objectionable smells—everything, in fact, appeared to be in favour of a continuance of this practice.

During the last year or two, since the skimming of the whey for buttermaking became more general, a number of the dairy factories have discontinued to treat the whey in this manner. The reason advanced—that the whey was so reduced in value that it was not worth the expenditure for heating—is quite a mistake, and dairy companies would be acting in the best interests of the farmers if they would insist upon the whey being pasteurized.—*D. Cuddie.*

FARM DRAINAGE.

A. McTAGGART, M.S.A.

THE first requisite in the treatment of a soil so that it will effectively grow a crop — be it cereal, root, tuber, legume, grass, or fruit — is to attend to that important physical factor, drainage.

In this land of normally copious rainfall the effective draining of the soil is essential for the full development of the agricultural resources of the country. True it is that the areas of greatest precipitation, situated more particularly along our western, southern, and south-eastern coasts, are most in need of drainage; also, that the swamp areas, the stiff clays, the lands with more or less impervious subsoil, and other soils waterlogged for either continuous or intermittent periods, call most urgently for the handicraft of the drainer to render them fertile or to increase their fertility. But there are few from among our great range of soil types that will not respond to drainage operations systematically conducted. Even hillside soils, more especially if of clay or clay-loam formation, can be benefited by a modified system of extracting the surplus water from the soil. Lands that are sometimes erroneously thought not to require drainage frequently show marked results when systematically treated from this physical standpoint, either by providing them with a complete drain arrangement or by augmenting the existing drains by means of intermediate water-channels.

UNDERLYING PRINCIPLES.

The benefits to be derived by the soil from effective drainage are many, and the more important may be here outlined before proceeding to deal with actual methods and the practice of draining.

A drained soil is more porous, a decidedly important fact, for an open soil with under-drains permits the surplus water to get away readily, and hence there is set up a free circulation of air instead of stagnant conditions. The air following into the soil promotes the formation of available plant-food in the form of nitrates, and aids the germination of seeds, consequently stimu-

lating the growth of plants. In a poorly drained soil the air is almost entirely excluded, for the pores are full of water, thus preventing germination and plant-growth from proceeding in a healthy manner. The small quantity of air in the pores pregnated with water soon becomes impure, since the roots give off poisonous substances, and the substitution of fresh for impure air is slow, owing to the smallness of the pores. The ventilation of a drained soil with its larger pores, however, is much more rapid and the soil-air much purer.

Effective under-drainage being provided and the air being admitted freely into the soil, there is set up a free circulation. The air over the surface of the ground heats rapidly under the strengthening warmth of the sun's rays, and this air circulating through the soil causes the soil particles, especially in the surface layers, to absorb heat, plant-growth being stimulated thereby. This is of special importance in the spring, when new growth begins to appear, for a favouring factor like thorough drainage is then specially desirable. It has been calculated that a drained soil is warmer than an undrained in the spring-time by from 5 to 12 degrees.

The heat received from the sun is used in three ways: some of it evaporates water from the soil, some heats the surface layers or seed-bed, and the remainder is conducted to lower layers. It is not fully realized how much of the sun's heat is used in evaporating water from the soil. As long as the latter looks wet on the surface evaporation is going on about as rapidly as from free water, and the amount of heat used by it runs from 25 to 50 per cent. of the total amount received from the sun. This at a time when warmth is needed to germinate crop-seeds is a serious loss. As soon as the soil begins to look dry on the surface the rate of evaporation falls off materially, and much of the heat formerly used in turning water into vapour is available for heating the surface layers. Undrained soil, being the more compact, remains moist on the surface, and evaporation from it continues at full speed long after it has been checked on the porous drained land. Moreover, loose soil is a poorer conductor of heat, and hence carries less of it down to the lower layers.

The difference arising from these conditions is accentuated by another cause: Water is the hardest known substance to heat, and since during most of the time the undrained soil is too wet and has more water in it than the drained, it follows that it must be colder. With the drained land saving heat because

evaporation is checked, conducting less to the lower layers, and at the same time being easier to heat, the temperature of its seed-bed is easily maintained from 5 to 12 degrees higher than that of the undrained.

A drained soil, when ready to cultivate, has more water in it for use by crops than an undrained soil when also ready. In the drained soil there is more room for water, owing to there being more pore-space. It has been estimated that the water saved in an average soil by drainage 3 ft. deep is about equivalent to one month's rainfall. Two things prevent rain from sinking rapidly into undrained soil — first the scarcity of pore-space, and second the air escaping upward, there being no other outlet for it. Half the surface pores must be full of escaping air, while the other half are full of descending water. In a drained soil the air can and does escape downwards through the drains as the water presses from above, and thus all the surface pores, instead of half, are absorbing water, while they are also larger than in the undrained soil. It follows, then, quite naturally that drained land must absorb water much faster than undrained, and therefore that run-off and consequent loss cannot occur as early on the former as on the latter. Thus the drained land effects a considerable saving of water at every shower.

The uppermost layers of the soil, where the roots feed, are incapable of storing enough water for crops even when aided by periodic rains; but at lower depths in the soil there are large quantities of water which travel slowly upwards and gradually reach the roots. Just in the same way as a liquid traverses a lump of loaf-sugar when one end is dipped into it, so the subsoil water travels upwards to the surface layers of the soil. This movement of liquids upwards or sidewise through porous bodies is known as capillary action or capillarity. The water travels from particle to particle by what is known as surface tension, and the finer (within certain limits) the soil particles, rendered fine by thorough and timely tillage, the greater the surface tension, owing to the fact that a fine soil has a greater surface area than a coarse soil. A finely divided soil also possesses more pore-space to be occupied by the ascending water — pore-space that under inadequate drainage conditions was occupied by stagnant water. Thus it is that a drained soil furnishes a greater and continuous flow of water from below for use by a crop.

Effective drainage, by lowering the permanent water-table and setting up greater pore-space, enables the roots of a plant to

penetrate more deeply in search of food and moisture. Thus the feeding-power, hence productiveness, of a plant is enhanced. The plant has also greater foothold and penetrating-power, and can more or less withstand adverse conditions such as high winds and dry periods. When roots of deep-rooted plants decay they provide humus for the lower reaches of the surface soil, also air-passages which increase the aeration and ventilation.

The first and one of the important results of the difference in temperature caused by drainage is that seeds germinate better. Every kind of seed has a temperature at which it germinates better than at any other. At too low temperatures many of the seeds will not germinate, and those that do grow very slowly. Drainage overcomes this slow incomplete germination.

Owing to its higher temperature, coupled with the presence of more fresh air, the drained soil is superior to undrained in another way. Soil contains myriads of bacteria, and these minute organisms prepare the food for plants. By their agency soil-constituents and manure are transformed into salts, which dissolve in water and with it pass into the roots to sustain the plant. These bacteria need fresh air as much as plants or animals do. In the drained land there is plenty of it. Moreover, a congenial temperature is needful as much to them as to man, and this, too, they find in the drained soil. Here, then, they thrive and flourish, combining the elements of the air with those of the soil, and give to the plant abundance of food made to its own liking. In the undrained soil, however, the scant supply of air becomes impure, and this, together with the cold, renders most of them so inactive that but little plant-food is prepared; one of the varieties, indeed, is so constituted that when air is scarce it lives on the food already fitted for the plant. It follows readily that the amount of plant-food available in drained far exceeds that in undrained land, while the more extensive root-systems in the former enable the plants to make full use of this advantage.

Arising out of these various special advantages of drainage are the larger practical benefits, being those of greatly increased productiveness, ability to cultivate or facilitate cultivation, and the promotion of healthier stock.

There are certain general indications that point to the need of a soil for drainage. These are the presence of rushes, sedges, and other water-loving plants; the tendency of pasture to run to the inferior bent grasses (fiorin, red-top, &c.), or to other

inferior grasses and weeds; the yellowing and disappearing of clovers, and a non-thrifty condition of pasture generally.

METHODS OF DRAINAGE.

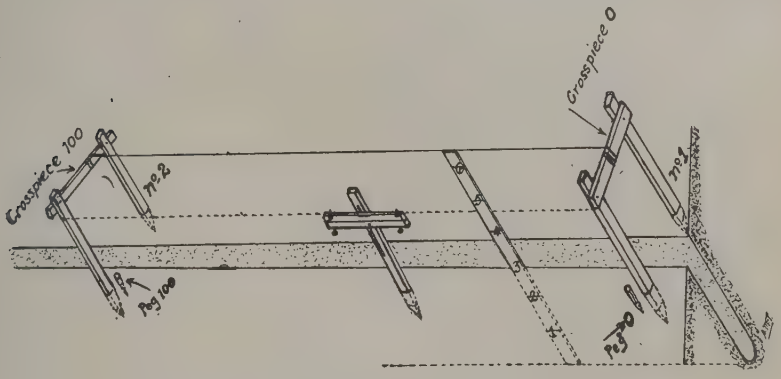
The first essential in effecting thorough drainage is to secure an adequate outlet, such as a large open ditch, a creek, or other depression sufficient to hold and carry a large volume of water. The next consideration should be whether or not there is sufficient fall or grade to the land. Land that has on the average a grade of at least 2 in. in 100 ft. can be drained, although it has been found possible to tile-drain land with a slightly shallower grade than this where the land farther back is much steeper—steep enough to permit the water therefrom to periodically flush the large shallow drainpipes laid in the flat area.

The fall and variations can readily be ascertained by taking readings with a level and a graduated staff held by an assistant at every 100 ft. peg along the proposed course of the main drain, commencing at the outlet, finding the difference between the readings at two points, and dividing this difference by the number of 100 ft. lengths between these two points. By ascertaining the fall over definite lengths of ground the grades to be finally adopted can be determined, so as to avoid excessive digging at a certain point or to ensure deeper excavation at another. The drawing of a profile of the main drain and larger laterals will at once represent to the eye the extent of the required shallowing or deepening. Level readings would require also to be taken along the course of the larger laterals at every 100 ft. peg as with the main drain.

A more detailed and thorough system of taking levels at regular points all over the field or farm, locating the position of every drain required for a complete drainage-system, and estimating every grade, length and size of tile, cost, &c. — the whole being plotted on a map — can, of course, be carried out if required. But this method hardly comes within the range of equipment of the average New Zealand farmer, and need not be elaborated here. It may be of interest to mention that excellent service of this kind for farmers is undertaken by the State in Ontario, where students from the Guelph Agricultural College perform the surveys and prepare the plans during the summer recess, for subsequent transmission to the farmers. At stated times during the survey-work a field demonstration in drainage is given by the student, with special reference to the most approved method of digging to a prescribed grade.

In general, the main drain should follow the lowest part of the field or farm. The laterals, the larger of which usually follow depres-

sions, should be led into this on either side on the herring-bone system, by which a lateral does not enter at a point exactly opposite the confluence of the opposing lateral with the main. Where the lateral enters the main the course of the former should be changed slightly in the direction of the flow of water of the main, so as not to check the flow. The size of the tile of the main drain will vary from 6 in. to 12 in., according to the grade. The shallower the grade and the greater the catchment area being drained the larger will be the tile. As a general rule, a 3 in. or 4 in. tile constitutes the laterals, and in the case of a sublateral a 3 in. pipe enters the 4 in. To thoroughly drain land, the laterals should be placed parallel at a distance apart of 25 ft. to 40 ft. on stiff clay soils, and of 70 ft. apart on average soils. An average



FARM DRAINAGE.
Overhead-line method of grading a ditch.

depth of 3 ft. has also been proved to provide the most satisfactory draw. The depth, however, may vary with the soil — the stiffer the soil the deeper, and the more open the soil the shallower, the drain.

Having decided upon the route of the main drain and the larger laterals, also determined with the aid of the level the grade or fall to be adhered to in each case, the digging to grade is the next consideration. A simple yet scientific method of effecting this is known as the overhead system, the principles of which are readily conveyed by the accompanying illustration.

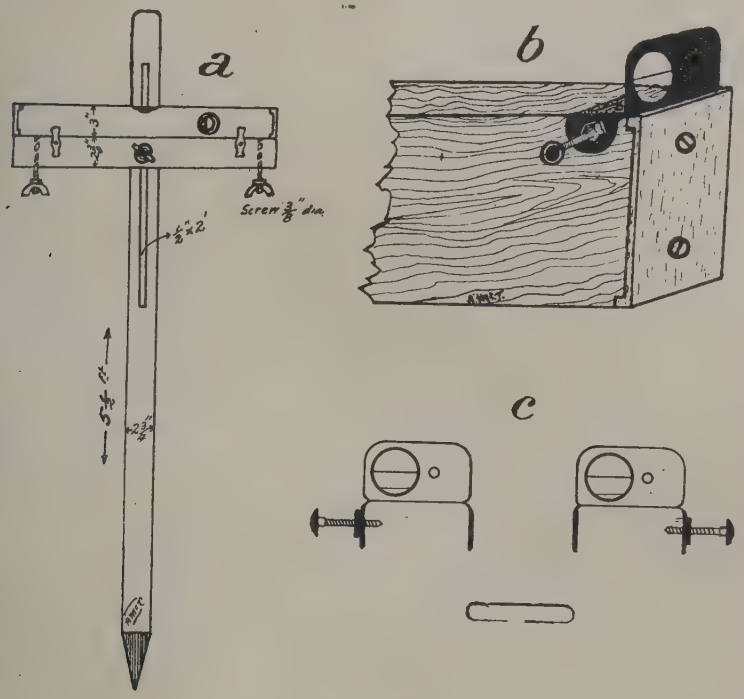
Knowing the grade of a particular proposed ditch, cross-pieces are erected at every 100 ft. mark, and one is placed at a height above the other according to the fall—*i.e.*, the number of inches in 100 ft. of the ditch to be dug. Commencing at the outlet in the

case of the main drain, or at the junction in the case of a lateral, at peg 0 a cross-piece (trued with the spirit-level) is erected 3 ft. 6 in. from the ground-surface. At peg 100 the cross-piece, as indicated, is erected the number of inches higher than that at peg 0 that there is in the fall or grade at this particular section, and so on with every 100 ft. section along the course of the proposed drain. A line is drawn over the two cross-pieces and usually weighted with two large stones.

Assuming that the ditch is to be 3 ft. deep on the average, the drainer, being provided with a rod 6 ft. 6 in. long, can now proceed with the excavation. (The plough could be used in the early stages of making the drain, before the cross-pieces are set up.) As he proceeds he periodically tests the distance between the line overhead and the ditch bottom. The line being 3 ft. 6 in. from the ground-surface enables the earth to be thrown out with a shovel without the cord being interfered with. Once the line is properly set up no special skill or schooling is required to dig a ditch the bottom of which corresponds exactly with the grade assumed by the cord-length.

A home-made level is an excellent instrument for readily ascertaining the elevation at which one cross-piece should be placed so as to form a definite grade with the previously erected and lower cross-piece. The level consists of a stake in which is cut a slot, along which a support for a spirit-level can be moved up or down by means of a bolt with hand-screw and washer attached. The spirit-level is held in place by two buttons attached to the support. Penetrating either end of the latter is an adjustable screw for readily truing the spirit-level. At either end of the level can be fastened a peep-sight, which is made from sheet brass. Drawn across the aperture of each of these peep-sights is a thin brass wire. The peep-sights are for eliminating the error caused by the optical illusion when sighting over a 50 ft. stretch. The stake is driven into the ground 3 in. or 4 in., and the level is supported at a required height and set perfectly level. The ditcher looks through the apertures of the sights on the level, keeping the wires in a direct line with his eye. His assistant runs a pencil up or down one of the stakes supporting the lower cross-piece, and finally makes a mark on this stake according to directions given by the person sighting. The assistant measures the distance between the pencil-mark and the cross-piece. The sighter now sights in the opposite direction, and directs the assistant to make a mark on an upright to which the next cross-piece is to be attached. This latter mark corresponds with the elevation denoted by the first pencil-mark. If this pencil-mark is above the first cross-piece, a

deduction corresponding to the measurement made by the assistant is made from the elevation denoted by the second pencil-mark on the upright placed at the second peg. But on this latter a plus allowance will have to be made for the fall—the number of inches in 100 ft. Thus cross-piece No. 2 will be placed not on a level with cross-piece No. 1, nor at the pencil-mark on No. 2 stake, but at a point ascertained by taking a distance below it corresponding



FARM DRAINAGE.

(*a.*) Home-made level. (*b.*) Method of attaching sights to spirit-level. (*c.*) Pair of peep-sights, and keeper for fastening sights together.

to the measurement made at No. 1 by the assistant, and then finding a point above this corresponding in height to the grade of this particular section of the proposed ditch (inches in 100 ft.). In the event of the sighting on No. 1 stake finding a point below the cross-piece, an addition will have to be substituted for a deduction in finding the point on No. 2 stake at which the second cross-piece should be placed. It is the top of the cross-piece that should correspond with these final points found on the uprights.

The illustration of the home-made level speaks for itself largely. The stake consists of a piece of wood 5½ ft. long by 2¾ in. wide and 1½ in. thick. The ½ in. slot begins 6 in. from the top, and is 2½ ft. long. The point of the stake may be shod with an iron shoe. The support is about 2 ft. long, the length of a long spirit-level, and is 1¼ in. thick. The total cost of this handy and simple instrument is only 6s. to 8s.

The trench having been dug, the tiles or pipes (which, by the way, should be well burnt) are readily placed firmly in position by means of a rod the end of which consists of a bend or crook. Where laterals are to be constructed, purchased pipe-joints set to the required angle may be used, or joints may be made by one who is deft with the hammer and cold chisel. The horn of an anvil is useful for this work.

SUBSTITUTES FOR PIPES.

A cheap yet effective substitute for drainpipes is good vigorous growth of manuka, cut in winter when the sap is down. Manuka wood thus cut will withstand the action of the soil for upwards of a dozen years. Tied with flax in bundles of, say, twenty to thirty sticks, and the bundles placed neatly end to end, the manuka forms a drain which approximates in form and practicability to that of the tile. Where the soil is loose it may be prevented from blocking up the water-channel formed by the manuka-rods by placing over these a few inches deep of brush. If this is not obtainable in sufficient quantity straw may be substituted. Where the soil is stiff and plastic but has not been puddled (as, for instance, clay) such protection is not necessary. Nevertheless, where plenty of brush is obtainable it could be used for this purpose, and so increase the effectiveness of the drain. The covering enables the loose disturbed soil to set instead of washing in between the strands of manuka. Even where tiles are placed beneath loose non-plastic soil a similar thin covering is of service for the same reason.

Where stones of various sizes are obtainable in abundance and handy, these may be substituted for pipes. Suitable selected stones of good size are placed edgewise on either side of the trench. On top of these one suitably shaped large stone, or two abreast, should be keystoned or wedged in. Above this smaller stones are placed, then the gravel, and finally subsoil and soil in proper sequence. This system, though entailing a good deal of patient labour, makes good and specially lasting drainage.

Drainage by labour-saving implements and machinery will be dealt with in an article to follow.

POLLEN-GRAINS AS SOURCE-INDICATORS OF HONEY.

R. WATERS.

WITH many plants superabundant pollen-production compensates for the uncertainty in character of the means of pollen-distribution. Besides an abundance of pollen, other devices for securing pollination are commonly met with. The fine colour, the attractive attributes and structure of certain flowers, for instance, adapt them to or even require the agency of insects. The bee ranks high among the important pollinating-insects. It is, however, not really interested in pollination; it finds in pollen, as in the nectar of flowers, a highly nutritive food-substance which it collects and stores for itself and its offspring. The bee is a utilizer of waste products. Thus we have pollen in honey.

The character of and demand for honeys vary with the nature of the available bee-fodder. For an apiarist to market a product free from undesirable qualities and approximating to some popular ideal he must know the floral effects of the districts in which he could operate. With a sound knowledge of the honey capabilities of flowers he might even predetermine the quality by the nature of the fodder he cultivates. Naturally, apiarists have long desired to know the value of pollen as a source-indicator of honey. The advantages to be gained from research in this direction are, however, so far entirely a matter of conjecture. The investigation here dealt with was undertaken to satisfy the increasing demand for this information on the subject. The following account sets forth the difficulties and successes met with, and the present status of the investigation.

The identification of pollen-grains is a subject on which very little is known. A collection of pollens from the parent plants was therefore obviously the first step. Objections were found to some of the preservative media customarily used in mounting microscopic objects. So delicate are the walls of certain pollens that they collapse in Canada balsam, in glycerine, and under the heat required for melting glycerine jelly. Moreover, many pollens are invested with an oily substance; when mounted in the media indicated air-bubbles consequently adhere to the grains, seriously hindering subsequent observations. The employment of an oil for

mounting (cedar-oil) after six months' trial proved satisfactory in overcoming both difficulties, but it rendered useless the commoner preparations for sealing cover-slips on the slide. A rapidly drying and highly efficient substitute was found in "film-cement," an adhesive used in the manufacture of cinematograph films. The addition of a colouring-matter (methylene blue) greatly facilitated the application of this otherwise highly transparent substance.

An attempt is now being made to arrange the pollens in groups of grains closely resembling one another and to comparatively describe them. The appended description of the pollen-grain of catsear (*Hypochaeris radicata*) will serve to illustrate the scope of the work. It may be noted that sulphuric ether has been employed for removing the oil films and throwing up the sculpture of pollens. The use of stains in certain cases naturally followed this treatment. As with seeds and individual plants, it will doubtless be found, particularly amongst nearly related species, that little or no observable distinction between certain pollens exists. Nevertheless, an imperfect system might be rendered useful with supplementary geographical and botanical knowledge.

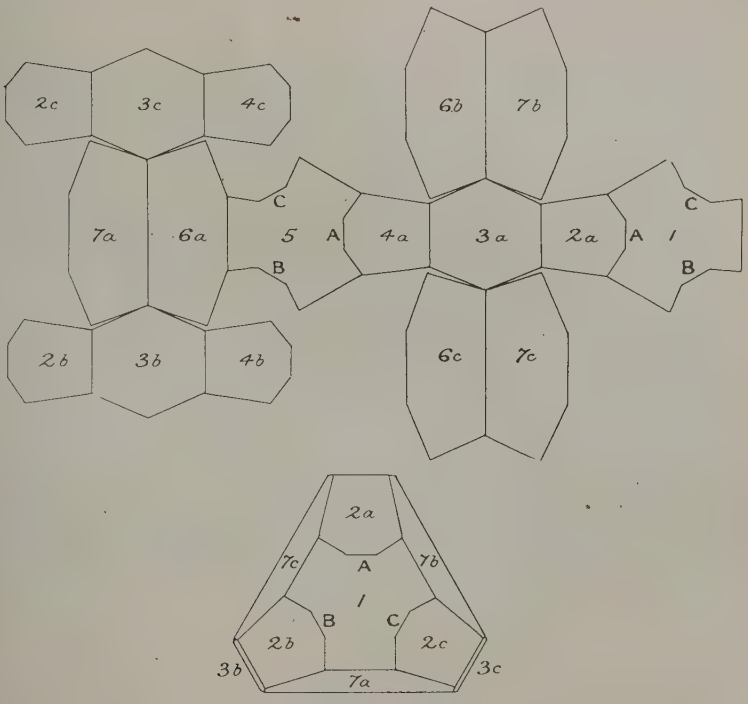
Pollen-grains are so minute that a magnification of four to five hundred diameters is necessary in the study of their superficial characters. The greater the enlargement the smaller the field of vision. It is therefore important to concentrate the grains of a sample in as small a part thereof as possible, so that many may be seen at once. Experiments are therefore in progress for rendering the fluid portion of a honey sample less dense than its contained grains, which then, theoretically, could be thrown to the bottom of a tube by means of a centrifugal milk-testing machine. In this connection it has been noted that the small quantity of liquid honey still left in an almost entirely granulated sample was very rich in pollen.

DESCRIPTION OF THE POLLEN-GRAIN OF CATSEAR (HYPOCHAERIS RADICATA).

The surface characters of the pollen-grain of catsear closely resemble those of hawkweed (*Crepis capillaris*) but differ materially from those of dandelion (*Taraxacum officinale*). The following is true of the first two :—

The surface consists of seventeen depressed faces, fifteen of which are six-sided, the remaining two being twelve-sided. Sometimes the latter are more or less faintly subdivided into three small areas. The borders of each face consist of raised edges evenly beset with spines and lying in the same plane. There are

four distinctly shaped faces (see flat diagram), as follows: (1) Two numbered 1 and 5; (2) six numbered 2 and 4; (3) three each numbered 3; (4) six numbered 6 and 7. There are, moreover, three series of these faces (if 1 and 5 are included in each series) which are the same in outline as a whole and also in their subdivision into faces. These three series are lettered A, B, and C, and consist each of seven faces. The three together form the entire surface of the grain.



POLLEN-GRAIN OF CATSEAR.

Flat and modelled diagrams of the bordered faces of the surface.

If the extremities of the flat diagram are curved downward, away from the reader, until they meet, so that the relation in positions of *2b* to *1b* and *2c* to *1c* exactly corresponds with that of *2a* to *1a*, a model of the grain may then be obtained similar to the model diagram.

The grains of catsear are slightly larger than, and of a different (more orange) yellow shade from, those of hawkweed, but the differences are probably too slight to be of value.

CERTIFICATE-OF-RECORD DAIRY COWS.

W. M. SINGLETON.

DURING the month of August an increased number of cows under semi-official test completed their records, and their owners have received certificates accordingly. The list given below represents those purebreds which have qualified since our last list, which was published in the May issue of the *Journal*.

JERSEYS.

As would naturally be expected, new class leaders become more and more rare as the maximum production for the class becomes higher and higher. On the present occasion, however, we have at least three records that require special reference in this connection. Lady Peggy, owned by Mr. E. Griffiths, New Plymouth, calving under two years of age, produced 534·31 lb. fat, and thus exceeds the very fine record of Mr. F. E. Hellyer's Lady of Collingwood, which after her first calf, dropped while she was under two years of age, produced 524·29 lb. fat. This makes the competition close, and since Lady Peggy is again entered for test the figures a year hence will be most interesting. These are two splendid individuals of the breed, and we believe the milking and care which has produced these records has developed the two cows mentioned as nothing else could have done.

In the older two-year-old class this return brings forth a new leader in Hill Crest Hope, owned by Mr. E. S. Lancaster, of Levin. Commencing at the age of 2 years 214 days, she produced in 365 days 10,733·9 lb. milk, containing 616·50 lb. fat. She displaces as class leader Mr. A. A. Ward's Miro, which produced in 365 days 8,835·7 lb. milk, containing 548·69 lb. fat. The record of Hill Crest Hope sets a comparatively high standard for her successor whenever she may appear.

Hill Crest Hope is a granddaughter of two C.O.R. bulls—viz., K.C.B. and Majesty's Fox. Each of these bulls has proved his power of transmitting that hereditary factor of butter-fat production by the one great test — that is to say, the butter-fat record of his progeny. Lady Peggy is a daughter of K.C.B., and it is interesting to note that the latter was some ten and a half

years of age when he sired this heifer. Unlike many instances of the sort, it is fortunate for New Zealand's dairy interests that this bull had not found his way to the block before his power of transmitting butter-fat production was well known. Many a good bull has been killed before his worth was appreciated, and the testing of purebred cattle has brought this home to some breeders so forcibly that, given a second opportunity, certain bulls would be used so long as they remained healthy and vigorous.

HILL CREST HOPE.

Owned by E. S. Lancaster, Levin. Days in milk, 365. Pounds milk, 10,733·9. Pounds fat, 616·50. Age, 2 years 214 days. Standard, 261·9 lb. fat.

Other outstanding records amongst the Jerseys are those of Orange Rose, Belvedere Sunbeam, and Belvedere Sultana. Orange Rose dropped her subsequent calf inside the year, and produced the remarkably fine record of 531·01 lb. fat in 335 milking-days. Belvedere Sunbeam had the misfortune to abort on the 231st day after starting the test. Had this accident not befallen her it would have been a striking production, and probably the highest record for the breed. Belvedere Sultana's record is one of the best in the three-year-old class, and does credit to a young man's first record cow.

FRIESIANS.

The black-and-whites provide one change in class leaders, and this record also proves the best for the breed. Manor Beet's Daughter II of Ashlynn, commencing her production at the age of 3 years 296 days, produced in 365 days 18,733·9 lb. milk, containing 863·51 lb. fat, dropping her subsequent calf in 13 months 1 day after the date of calving for commencement of test. This cow is owned by Mr. C. A. Hopping, of Glen Oroua, and represents North American strains exclusively. She is by Grace's

LONGBEACH VI.

Owned by W. I. Lovelock, Palmerston North. Days in milk, 365. Pounds milk, 17,807·7. Pounds fat, 630·25. Age, five to six years. Standard, 350 lb. fat.

Netherland of Riverside (imp.), a bull with a fine list of large-record daughters to his credit. Her dam was by Colonel Manor of Riverside (imp.) and out of de Kol Manor Beet's IV Daughter (imp.). As a cow she is comparatively fine-boned, and although while on record she was in fair condition she is not one to carry flesh. Her production displaces as leader of the senior three-year-olds Dutchland Colantha Mercedes, owned by Mr. G. Aitchison, of Kaitangata. The latter cow's production was 756·99 lb. fat, commencing at the age of 3 years 335 days. As the highest-record cow of the breed Manor Beet's Daughter II of Ashlynn takes

precedence of Mr. J. Donald's Netherland Princess IV, which has a record of 805·77 lb. fat, she having commenced her test at the age of 2 years 341 days.

Two other daughters of Grace's Netherland of Riverside figure in this month's list. Dutch Queen of Ashlynn, as a five-year-old, produced in 303 days 592·16 lb. fat, and Leila Mooie Blanco IV of Ashlynn, commencing at the age of 3 years 331 days, produced in 290 days 626·06 lb. fat. Leila Mooie Blanco III of Ashlynn, with

LADY OF CLINTON.

Owned by McPhail Bros., Clinton. Days in milk, 365. Pounds milk, 11,194·5. Pounds fat, 402·37. Age, five to six years. Standard, 350 lb. fat.

a record of 652·21 lb. fat in 321 days, is a daughter of Colonel Manor of Riverside (imp.). The latter two trace only to North American strains.

Mr. W. I. Lovelock's Cliffside Lassie's record of 516·24 lb. fat in 332 days represents a good performance, and places this cow well up in the senior three-year-old class.

Other records now published represent good businesslike work, and while not as high as some of the class leaders, they indicate efficiency and capacity.

AYRSHIRES.

Only three Ayrshire records are available for publication. It is a peculiar coincidence that each of these three Ayrshires necessarily milked comparatively short periods. Each of the three dropped a mature calf under eleven months from the commencement of her test.

LIST OF RECORDS.

Name of Cow.	Name and Address of Owner.	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Two-year-old Class.		Yrs.Dys.			lb.	lb.
Lucky Dorothy ..	C. Stevens, Maungatapere	1 227	240·5	365	5923·10	311·99
Laurel's Petite's Darling	F. Cresswell, Ballance	1 337	240·5	319	6370·10	341·15
Middlewood's Wonder	D. H. Kilgour, Kiwitea	1 289	240·5	365	6671·30	323·45
Lady Gwendoline ..	T. Foreman, Alton ..	1 359	240·5	343	4838·20	321·31
Laurel's Gipsy Countess	F. Cresswell, Ballance	1 346	240·5	332	6489·50	338·29
Lady Peggy ..	E. Griffiths, New Plymouth	1 308	240·5	365	8265·10	534·31
Hill Crest Hope ..	E. S. Lancaster, Levin	2 214	261·9	365	10733·90	616·50
Trethella's Duchess..	E. S. Holdaway, Ballance	1 301	240·5	332	4482·60	249·85
Welcome	Ditto	1 357	240·5	333	4998·80	249·66
Jewel's Mystery ..	J. F. Vosper, Matamata	1 287	240·5	365	6515·40	424·96
Golden Swan's Lady	A. Moreland and Sons, Papatoetoe	1 339	240·5	281	5010·25	276·79
Patch I Beauty ..	J. Guy, Manaia ..	1 363	240·5	325	5840·60	302·29
Three-year-old Class.						
Waif's Friskey ..	A. A. Ward, Miro, Taranaki	3 323	309·3	336	6996·60	419·93
Belvedere Sultana ..	E. B. Eagle, Belvedere, Carterton	3 323	309·3	365	11433·50	530·56
Four-year-old Class.						
Belvedere Sunbeam..	P. J. Peterson, Midhirst	4 333	346·8	231	13522·20	553·06
May Blossom's Maid	Clague Bros., Manaia	4 199	333·4	316	9539·80	442·78
Michaelmas Daisy ..	Ranford Bros., Stratford	4 52	318·7	302	5635·20	337·74
Mature Class.						
Lady Rose ..	E. Eagle, jun., Belvedere	8 330	350·0	257	8266·30	466·42
Snowslip	J. T. Whitehouse, Matatoki	10 354	350·0	365	7227·10	394·05
Golden Topsy ..	C. Stevens, Maungatapere	10 291	350·0	365	7387·30	358·58
Ravenswood Darkie II	H. Stratford, Awapuni	5 327	350·0	310	7587·80	452·64
Orange Rose ..	F. Cresswell, Ballance	10 333	350·0	335	9730·50	553·01
	FRIESIANS.					
Junior Two-year-old Class.						
Keyes Plus Triumph	H. North and Sons, Omimi	2 142	254·7	323	11337·90	346·92
Lady Johanna Piebe de Kol	W. Remnant, Palmerston North	2 139	254·4	365	16099·00	452·50
Pauline Canary ..	C. C. Buckland, Cambridge	2 162	256·7	365	8146·70	288·66

LIST OF RECORDS—*continued.*

Name of Cow.	Name and Address of Owner.	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS—*continued.*					
Senior Two-year-old Class.		Yrs.Dys.			lb.	lb.
Countess Ena II ..	W. I. Lovelock, Palmerston North	2 190	259·5	365	15039·90	473·01
Pauline of Sunnycroft	C. C. Buckland, Cambridge	2 191	259·6	365	9361·20	290·52
Princess Paul Pietertje	J. Donald, Westmere	2 339	274·4	280	10388·60	386·08
Junior Three-year-old Class.						
Netherland Duchess Pietertje	J. Donald, Westmere	3 103	287·3	331	11019·70	383·82
Senior Three-year-old Class.						
Alma III of Brundee	W. Potter, Mangere, Auckland	3 264	303·4	365	12003·00	409·20
Dominion Milkmaid	Weraroa Experimental Farm, Levin	3 321	309·1	353	10786·50	348·16
Cliffside Lassie ..	W. I. Lovelock, Palmerston North	3 305	307·5	332	11283·20	516·24
Sunflower of Ashlynn	C. A. Hopping, Glen Oroua	3 317	308·7	251	11308·80	498·30
Leila Mooie Blanco IV of Ashlynn	Ditto	3 331	310·1	290	14671·70	626·06
Manor Beets Daughter II of Ashlynn	,, ...	3 296	306·6	365	18733·90	863·51
Beauty	S. R. Solley, Riverlea	3 274	304·4	365	13325·20	434·49
Mature Class.						
Glendowie Beauty ..	C. C. Buckland, Cambridge	Mature	350·0	365	11135·20	454·25
Glen Dhu Beauty ..	R. Gilmour, Tiakitahuna	8–9 yrs	350·0	365	10560·30	396·02
Bessie Woods ..	N. Carter, Netherton, Paeroa	7–8 yrs	350·0	350	11275·10	396·98
Dutch Queen of Ashlynn	C. A. Hopping, Glen Oroua	5 304	350·0	303	13590·40	592·16
Leila Mooie Blanco III of Ashlynn	Ditto	5 295	350·0	321	15022·40	652·21
Oakwood Beauty ..	A. J. Gallichan, Tiakitahuna	10–11 years	350·0	315	14637·20	502·31
	AYRSHIRES.					
Two-year-old Class.						
Princess Charlie of Cambridge	Watt Bros., Cambridge	2 236	264·1	306	6042·90	284·05
Mature Class.						
Bonnie Stately of Koputaroa	C. E. C. Webb, Koputaroa	6 289	350·0	311	10065·60	357·15
Reta of Townhead ..	F. Mills, Waipapa, Hawera	5 325	350·0	316	9790·30	392·64
	MILKING SHORTHORNS.					
Mature Class.						
Pansy I	E. Law, Shannon ..	5 335	350·0	304	9478·50	354·52
Maisie	,, ,, ..	6 334	350·0	364	10021·00	431·30

SEEDS AND THEIR IDENTIFICATION.

CONTINUED.

E. BRUCE LEVY.

(1.) Ordinary Catsear (*Hypochaeris radicata*).
(2.) Glabrous Catsear (*Hypochaeris glabra*).
(3.) Dandelion (*Taraxacum officinale*).
(4.) Hawkbit (*Leontodon hirtus*).

ORDINARY catsear is one of the commonest impurities in seed harvested in New Zealand, and samples of rye-grass, crested dogstail, Chewings fescue, and cocksfoot are rarely ever free from this weed-seed. The presence of catsear in a line of seed is of no particular consequence provided the quantity is small and that the line has a good germination-capacity. It cannot be too firmly borne in mind that the harmfulness of weed-seeds depends to a large extent on the germinating energy of the seed in which they are found. A poor germinating line leaves large empty spaces in the field which provide a suitable bed for the propagation of the weed-seeds. In a good "take," however, weeds of catsear type have little chance in the contest for supremacy.

Glabrous catsear is very rarely found as a seed impurity, and the plant, even when established in a pasture, is of less consequence than is the ordinary catsear.

Dandelion-seed, although the plant is quite common in the field and waste places, is not a frequent impurity in agricultural seeds.

Hawkbit is fairly common, but its presence in a line is not to be looked upon as of any great consequence.

ORDINARY CATSEAR.

Size: Average length without beak, $\frac{1}{5}$ in.; average width, $\frac{1}{40}$ in.

Colour: Varies from a deep orange-yellow to a rich dark brown; usually rich dark brown.

Shape: Elongated, somewhat spindle-shaped; round or nearly so in section. The apex is drawn out into a long beak ter-

minated by a feathery pappus. In seeds found in samples, however, the pappus and the greater part of the beak is broken off. Usually a beak about one-quarter the length of the seed remains. At times the beak is completely removed. The base is bluntly pointed and bears a more or less well-defined scar the centre of which is depressed. Extending from the base to the apex are fifteen longitudinal finely toothed ridges. The spaces between the ridges are fairly smooth and are often of a slaty colour. The seed is usually straight, but at times is decidedly

ORDINARY CATSEAR (HYPOCHAERIS RADICATA). ENLARGED 10 DIAMETERS.

twisted, resembling a minute spindle. In general appearance the surface of the seed is dull and much roughened.

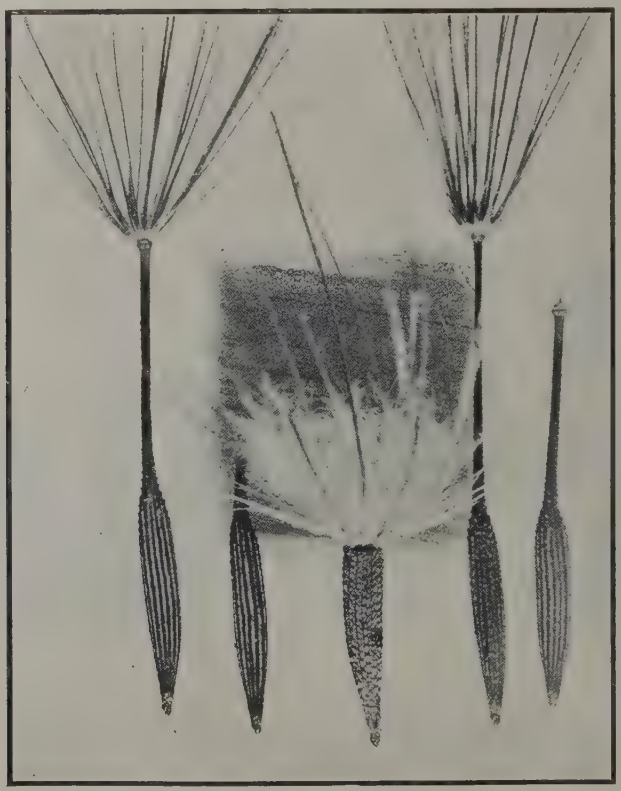
GLABROUS CATSEAR.

Size: Average length without beak, $\frac{1}{7}$ in.; average width, $\frac{1}{47}$ in.

Colour: Rich very dark brown.

Shape: Elongated and round in section like ordinary catsear. The apex is drawn out into a fairly long beak terminated by a feathery pappus. The beak is lighter in colour than the rest of the seed; the pappus is a dirty light yellow in colour and is probably more persistent than that of ordinary catsear. The

base is pointed and bears, usually on the side, a small depression. The surface of the base opposite the depression is smooth and often of a lighter colour. Extending from the base to the apex are fifteen longitudinal finely toothed ridges. Towards the base of the beak the teeth on the ridges are very marked. Fine



GLABROUS CATSEAR (HYPOCHAERIS GLABRA). ENLARGED 10 DIAMETERS.

teeth extend almost the whole length of the beak. The spaces between the ridges are smooth and usually of a slaty colour. The seed is straight, and has not the spindle-like twist often noticeable in ordinary catsear.

Some seeds of glabrous catsear have no beak whatever. The pappus, which is extremely feathery and white in colour, arises

from the body of the seed. Such seeds are present on the outside of the seed-head. The ones with the beak are borne on the central portion of the head. In general appearance the surface of the seed is dull and much roughened.

DANDELION.

Size: Average length without beak, $\frac{1}{6}$ in.; average width, $\frac{1}{23}$ in.

Colour: Dull yellowish-brown tinged with green.

Shape: Lanceolate (shaped like head of a lance) and flattened. The seed has four ridges, one ridge on each edge and one down

DANDELION (TARAXACUM OFFICINALE). ENLARGED 10 DIAMETERS.

the middle of each face. On each side of the middle ridge is a well-marked groove the edges of which are frequently raised so as to give the appearance of two additional ridges on each side of the middle ridge. Thus one large and four smaller ridges are often present on each face. Occasionally three ridges are present on one face. Towards the apex of the seed and mounted on the ridges are many blunt prominent teeth which give the lance-shaped seed a barbed appearance. From the barbed apex arises a long slender beak surmounted by a feathery pappus. Very

rarely, however, is this beak and pappus present, the beak generally being broken off quite close to the apex of the seed. The base is bluntly pointed and bears generally a well-defined circular depression. The seed is usually slightly curved, the curvature being for the most part in the edge, occasionally, however, in the flattened face. In general appearance the surface of the seed is dull and much roughened.

HAWKBIT (LEONTODON HIRTUS). ENLARGED 10 DIAMETERS.

HAWKBIT.

Size: Average length with beak, $\frac{1}{5}$ in.; average width, $\frac{1}{45}$ in.

Colour: Light to a rich dark brown.

Shape: Elongated and somewhat flattened. The seed is surmounted by a feathery pappus, dirty yellow in colour, and borne on a very short beak. This pappus is very persistent, and is almost invariably attached to the seed when the latter is found as an impurity. The base is pointed and bears a peculiar scar. This scar is lighter in colour and has a depression in its middle. It is divided up into segments, usually as many segments as there

are deep grooves down the seed. Extending from the base to the apex, more or less distinctly, are fifteen or sixteen blunt ridges bearing small teeth, which increase in size towards the apex of the seed, where they are well marked. The grooves between the ridges vary in depth, there being generally five or six fairly deep ones. These deeper ridges extend across the scar at the base and divide it into the segments referred to above. The terminus of the short beak is expanded like a water-bottle, and the pappus rises from its middle portion. The seed is more or less straight; often slightly curved. In general appearance the surface is dull and much roughened.

HAWKBIT (LEONTODON HIRTUS).—SEED OF THE OUTER RAY-FLORET. ENLARGED 10 DIAMETERS.

In the hawkbit seed-head are seeds of two quite distinct appearances. The one above described is found in the central portion of the head. Around the outer ray of the head are borne seeds usually much curved and with a very small rudimentary chaffy pappus. In size these seeds are—average length, $\frac{1}{6}$ in.; average width, $\frac{1}{32}$ in. The seed is shorter and stouter than the central ones and usually of a light-brown colour. The ridges are not so prominent, but the seed bears from five to ten fairly deep grooves which extend from the base almost to the apex. The seed is generally rough and studded with teeth, especially towards the apex. At times, however, the surface is fairly smooth.

The following table, compiled from analyses made in the Biological Laboratory, shows the relative frequency of occurrence of these four seeds in the main agricultural seeds.

Agricultural Seed in which found.	Of 100 Samples examined			
	Ordinary Catsear was noted in	Glabrous Catsear was noted in	Dandelion was noted in	Hawkbit was noted in
Perennial rye-grass ..	50	..	..	3
Italian rye-grass ..	31	1	..	4
Cocksfoot	76	..	2	..
Crested dogstail ..	70	..	..	7
Chewings fescue ..	72	..	..	..
Timothy	2	..	..	..
Fiorin	8	..	..	8
Meadow-foxtail ..	2	..	..	..
Poa pratensis	..	..	4	..
White clover	4	..	..	..
Alsike	..	..	..	..
Red clover	6	..	..	..
Cow-grass	3	..	..	..
Lucerne	4	..	..	..
Lotus	12	..	..	4

Ordinary catsear was noted also in hard fescue, *Danthonia pilosa*, Yorkshire fog, *Poa nemoralis*, yarrow, red fescue, Western Wolths, rye-grass, sheep's fescue, oats, rib-grass, *Danthonia semiannularis*, meadow-fescue.

Dandelion was noted also in *Poa trivialis*.

Hawkbit was noted also in meadow-fescue.

A PREVENTIVE LICK FOR BUSH SICKNESS.

For some months past experiments have been carried on by the Department at the Mamaku Farm with a lick for cattle, the object being to ascertain whether it is of real practical value as a preventive of bush sickness. The lick is in the form of a solid block, and its ingredients are perchloride of iron, common salt, sulphate of calcium, and hydrate of calcium. The calcium (lime) is necessary for binding the materials together. So far this lick has had encouraging results—more so than any other medicinal agents given in the form of licks. Phosphate of iron, it will be remembered, proved effective as a cure when administered daily over a considerable period, and it now appears that the simple combination of perchloride of iron, salt, and lime is valuable as a preventive.

In order that farmers in the affected area may have an early opportunity of using this lick, a supply has been sent to the Manager of the Experimental Farm, Mamaku (Mr. R. A. Jackson), from whom it can be obtained on personal application. Actual cost price only is charged—viz., 9d. per block.

GRAFTING OF FRUIT-TREES.

J. A. CAMPBELL.

THERE are two processes adopted in altering the character of a tree and the fruit it bears; these are known as "budding" and "grafting."

Budding is usually done in the months of January and February, and is the universal method adopted in raising young trees, or under circumstances when the wood is not more than one or two years old. Although budding can be successfully done on older wood, grafting is the method generally adopted in such cases.

From time to time the orchardist finds it is advisable to graft certain of his trees, usually for one or other of the following reasons: To alter the character of the tree by converting it into a variety more suited to either the local or the export market; to reduce the number of varieties when too many have been planted; to convert badly blighted trees into more resistant varieties; to stimulate growth in trees more or less exhausted. Grafting is the universal method of effecting these changes, and is generally known as "top-working" or "working over."

Although the grafting of a tree offers no great difficulties, and is, in fact, an operation that can scarcely fail provided the time and conditions are right and a little care exercised, many growers hesitate to undertake the work themselves, and usually employ the services of an expert. Where there is much of the work to be done the employment of an expert may be a wise precaution, but in the case of only a few trees there is no reason why any man of ordinary intelligence should not successfully attend to them.

In preparing a tree for grafting, the head is usually cut away during the winter to within a few inches of the point of grafting. The remainder, which is more or less dry, is cut away later, when the work is being performed: this provides fresh wood to work upon. The cutting-back in the winter is not a necessity, but is usually done with the view of avoiding unnecessary littering of the ground in the early spring, after the cultivation has been completed. Heavy branches should be lightened before being cut from the tree, in order to avoid splitting and tearing the bark. Grafting should be done in the early spring, and can be commenced as soon as the bark will lift cleanly from the wood. Scions should be wood of the previous season's growth, and taken from a healthy tree.

Although successful work can be done with wood taken from trees at the time the work is being done, the results are not as reliable as when well-preserved wood selected when quite dormant is used.

There are several methods of grafting practised, but those usually adopted are what is known as the "rind," "cleft," and "whip" grafts.

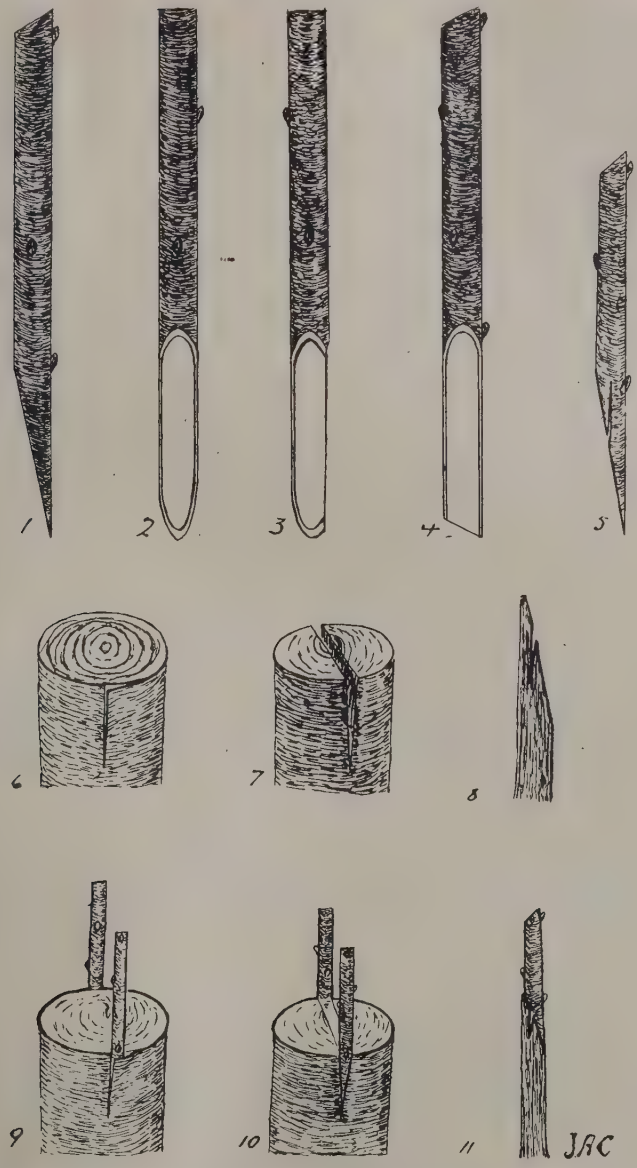
The Rind Graft.—This is one of the surest and simplest methods of reworking a matured tree. The process is as follows: Prepare the stock by cutting back to the required point, which should be as low down in the crown of the tree as circumstances will allow; make a vertical slit in the bark with a budding knife and carefully raise the bark on one side of the slit. (See Fig. 6 in illustration.)

To prepare the scion take a piece of healthy one-year-old wood bearing about three to four buds. Make a clean sloping cut commencing about 1½ in. from the base and a little above a bud on the reverse side (Figs. 1 and 2). Slightly square the edge of the scion at right angles to the first cut and on the side corresponding with the unraised bark of the stock (Fig. 3). Insert the scion under the raised bark of the stock, bringing the squared edge up tightly to the unraised bark (Fig. 9).

To hold the scion in place and to exclude the air, a bandage made of waxed cloth is tightly bound round the top of the stock, the edges of the cloth being also tightly packed into all crevices at the base of scion, &c. The cut top of the stock should also be painted with grafting-wax. Two or three scions according to the size of the limb are often thus placed. This is to provide a reserve in case of one or more being damaged, also to assist the stock to heal over more quickly, so as to prevent the bark dying back through disease and rot.

Rind grafting can, of course, be done in the old way, by raising the bark on both sides of the vertical slit, in which case the base of the scion is not squared at the sides as explained, otherwise the process is the same.

The Cleft Graft.—This method of grafting (Fig. 10) is commonly used in working grape-vines and also fruit-trees. The stock is prepared in the ordinary way and split through the centre (Fig. 7). The split is held open with a chisel or chip of wood until the scion is inserted. The scion in this case is bevelled on both sides, with the outer edge a little thicker than the inner (Fig. 4). The inner bark or cambium of scion and stock must come into direct contact for the union to take place; this is more readily assured if the scion slopes outward slightly, the point of contact and union taking place where the inner barks cross. Cover the top of the stock with waxed cloth, and bind to exclude the air and to hold the scions in place, as in rind grafting.



GRAFTING OF FRUIT-TREES.

1. Rind graft: Side view of scion. 2. Rind graft: Front view of scion. 3. Rind graft: Front view of scion with squared edge. 4. Cleft graft: Side view of scion. 5. Whip graft: Side view of scion. 6. Rind graft: Limb prepared for grafting. 7. Cleft graft: Limb prepared for grafting. 8. Whip graft: Stock prepared for grafting. 9. Rind graft: Scions inserted. 10. Cleft graft: Scions inserted. 11. Whip graft: Union of stock and scion.

The Whip Graft.—This method (Fig. 11) is usually adopted in working young trees, or in cases where the stock is not sufficiently large to allow of rind grafting. The stock is prepared by making a smooth, sloping cut of about 2 in. in length. An incision is made in this with the grafting-knife (Fig. 8). This incision should not be made in the centre of the sloping cut of the stock, but rather more toward the top. The scion is made to correspond with the stock. The tongue of wood formed on the scion through the incision made by the knife fits into the incision on the stock, and *vice versa*. As the scion scarcely ever corresponds in size with the stock, it is necessary to carefully bring the inner bark of the two sections in direct contact on either one side or the other. Bind with raffia or waxed cloth to exclude the air.

Grafting-wax.—The following is a good recipe for preparing grafting-wax, the chief object of which is to exclude the air from the cuts on both stock and scion: 4 lb. resin, 2 lb. beeswax, 1 lb. mutton tallow. Dissolve over a slow fire and apply warm. The wax should not be made hard enough to crack after being applied.

DEPARTMENTAL DIVISIONS.

THE scope of the four Divisions of the Department of Agriculture having become fairly well known to the public, it was recently decided that the time had arrived when shorter designations for the Divisions could be used with some advantage. The names have therefore been altered as follows:—

New Name.	Old Name.
Fields Division ..	Fields and Experimental Farms Division.
Live-stock Division ..	Live-stock and Meat Division.
Horticulture Division ..	Orchards, Gardens, and Apiaries Division.
Dairy Division ..	Dairy-produce Division.

There has been a brisk inquiry recently for Ruakura-bred milking-strain yearling Shorthorn bulls. In the last half of August seven sales were made, and no young Shorthorn bulls available for service this season are now left. Eleven cows of the Ruakura Shorthorn herd which had registered under semi-official test were entered last month in the Herd-book of the Waikato Dairy Shorthorn Association.

The cost of keeping pigs at the Ruakura Experimental Farm is found to be small in comparison with the returns given. This is mainly due to the fact that the whole of the pig-food is grown on the farm. A great deal of this food would practically be waste if not fed to pigs.

THE SUNFLOWER (HELIANTHUS ANNUUS).

JOSHUA BEVERLEY.

OIL-PRODUCING plants have come in for more attention of late years, especially those, such as the sunflower, which are easily cultivated and from which a good return may be expected.

Helianthus annuus is supposed to be a native of Mexico, and to have spread throughout the temperate and subtropical zones from Europe to as far as India and China. The cultivation of the sunflower is easy. From 6 lb. to 8 lb. of seed is required to sow an acre. The seed should be planted an inch deep, and when the plants are a foot high they should be earthed up, and need then receive no further attention. In Russia the seed is sown in drills 2 ft. apart, and the plants are afterwards thinned to give about 12,000 plants per acre. Up to 16,000 plants have been successfully grown on an acre of land in England. It seems advisable to have rather wider rows—say, 28 in.—and to space the plants 15 in. apart in the rows. Horse cultivation can be better carried out with this space between rows. Topping the plants is recommended in order to increase the yield per acre.

The sunflower does best on rich calcareous soils. On really good land the yield per acre should be something like 50 bushels. One bushel of seed yields approximately 1 gallon of oil. The white-seeded variety is said to yield more oil than the dark-seeded kinds.

At the Moumahaki Experimental Farm in the past season a dark-seeded variety, Russian Giant, was successfully grown. The seed was planted in October, and the crop was ready to harvest early in March.

The sunflower is rather an exhausting crop so far as potash is concerned. A means to counteract this is to burn the stalks and spread the ashes over the land; it is said that the stalks grown on an acre contain from 15 cwt. to 20 cwt. of potash. An analysis of the ash of the plant (given by the *Pharmaceutical Journal*) includes, in round numbers, the following constituents: Potash 48, lime 10, magnesia 5, and phosphoric acid 10 per cent.

The oil is of great value. Besides being used in some parts for table purposes, it is employed in the manufacture of paint (especially for greens and blues); it also makes soap of great softness. It burns well. The seed is a valuable food for poultry. The

seed, shelled and ground, makes very fine sweet flour for bread; if roasted and ground it forms a substitute for coffee. The marc is superior to linseed-cake for fattening cattle. The leaves may be used as fodder either fresh or dry. The flowers are useful in providing honey. By treating the stem of the plant like that of the European flax a very fine fibre, nearly as fine as silk, is produced. Few economic plants, indeed, are more valuable than the sunflower, and it would appear to deserve greater attention for commercial purposes in this part of the Empire.

It is reported that, acting under official advice, special efforts were made this year by the people in Germany to increase the area under sunflower, the produce of small plots being received at collecting-depots for bulking and subsequent treatment.

PRUNE-GROWING IN CALIFORNIA.

MR. E. CLIFTON, New Zealand Trade Commissioner, San Francisco, contributes the following note:—

This year's prune crop of Santa Clara County, California, is estimated at 85,000,000 lb. weight, and it is expected that it will be sold at the rate of 5 cents (2½d.) per pound. The acreage from which this crop is harvested is 53,000 acres. The Santa Clara Valley is thirty-seven miles from San Francisco, its county town being San Jose. It may be said that this county lives entirely on the prune. It extends across a long sweeping valley to the low foothills, every acre in intense cultivation, a great part of it levelled for irrigation.

The members of the Press delegation who visited this valley lately were greatly interested. To travel for miles along a well-formed asphalted road as smooth as a city street in New Zealand, with orchards on either side unprotected by fencing, is a revelation to us from other countries where orchards are jealously guarded. The extent and perfect cultivation of the orchards is very striking, and it may be added that the system of pruning adopted by the prune-growers permits of the development of a much larger tree than is usually the practice in New Zealand.

In the prune industry of California the grower disposes of his output to the drying-houses. The whole business—from the various processes of pruning, spraying, irrigation, carriage to the drying establishments, sorting, pickling, and drying, to the final packing—is absolutely systematized. There is no waste of labour, and no precaution left untaken to assure the quality of the finished product.

LIMESTONE.

NORTH ISLAND ANALYSES.

B. C. ASTON, F.I.C.

ONE of the most promising ways of increasing the productiveness of this country at the present time, when the obligation to produce to the uttermost must be apparent to all, is by a more general use of ground limestone (carbonate of lime). This statement is more generally true of the North Island lands, which are so responsive to even small dressings of ground limestone, and the greater part of which, according to official records, has a rainfall of between 50 in. and 70 in., while the driest portion—a comparatively insignificant part of the whole—has no less a rainfall than from 30 in. to 40 in.

Carbonate of lime is one of the constituents of soils which is most readily lost by leaching. It is the exception to find any virgin soil in New Zealand with a perceptible quantity of carbonate of lime. On recent papa slips one may perhaps find a few per cent., and this is no doubt why such abundant and nutritious growth soon covers these calcareous mudstone faces, and why the slipping of acres of old pasture is regarded in this area with equanimity by farmers.

It has been calculated that 143½ tons of carbonate of lime are annually removed by solution from each square mile of land in England and Wales, and that the average amount thus removed from each square mile of the earth's surface is about 50 tons. From this one would expect that the arid regions of the earth would, other things being equal, be much richer in carbonate of lime than the humid regions, and this is found to be the case.

It is with the idea of drawing attention to the abundant supplies of limestone which are distributed over the North Island that the analyses given in the following pages have been brought together.*

It will be observed that the following counties are not represented in the list: Whangaroa, Eden, Thames, Ohinemuri, Ohura, Matamata, East Taupo, Rotorua, Piako, Tauranga, Whakatane,

* The South Island will be dealt with in another issue of the *Journal*.

Waiapu, Taranaki, Egmont, Waimate West, Hawera, Eltham, Whangamomona, Waitotara, Waimarino, Kaitieke, Kiwitea, Kairanga, Manawatu, Horowhenua, Castlepoint, Hutt, Makara, Waipawa, Weber.

ANALYSES OF LIMESTONES: NORTH ISLAND.

(Compiled from Official Reports.)

Lab. No.	Locality.	Insoluble Matter (Sand, &c.).	Alumina and Iron Oxides.	Calcium Carbonate ($CaCO_3$).	Magnesium Carbonate, &c.	Moisture, &c.	Approximate Yield of Quicklime (CaO) in Calcined Limestone.	Year of Analysis.	Remarks.
	Mangonui County.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
3948	Awanui	39·97	1·40	55·50	2·99	0·14	..	1884	Compact stone.
6067–1	Parengarenga ..	22·25	2·21	71·45	2·97	1·12	..	1892	Lithographic limestone.
2	,, ..	44·68	2·63	48·84	1·84	2·01	..	1892	Siliceous limestone.
G 154	Kaitaia	..	..	63·61	..	..	..	1906	
155	,, ...	..	..	59·89	..	..	..	1906	
156	,, ...	18·90	1·00	78·21	0·30	..	68	1906	
D 421–1	Victoria Valley ..	25·25	2·05	70·88	1·82	..	58	1914	Inferior stone.
2	,, ..	33·28	2·27	62·27	2·18	..	48	1914	,,
3	,, ..	35·41	2·06	61·49	1·04	..	47	1914	,,
	Hokianga County.								
8345–1	Kohukohu ..	6·25	1·01	89·98	2·14	0·62	83	1899	Calcareous sinter.
2	,, ..	2·97	0·91	93·14	2·38	0·60	90	1899	,,
1835–1	Camp Bay, Hokianga	0·95	1·25	96·43	0·10	0·72	95	1909	
3	Pirau River, Hokianga	37·10	4·55	55·64	2·20	0·56	..	1909	
1842–3	Towai Creek, Hokianga	27·10	6·33	62·31	0·30	2·32	..	1909	
4	Waikaraka, Hokianga	14·25	7·54	76·90	0·30	0·45	..	1909	
E 897–1	Waimamaku, Hokianga	8·93	0·68	89·75	0·64	..	83	1915	Fairly good stone.
2	Ditto	16·51	1·12	82·27	0·10	..	74	1915	Rather poor stone.
	Bay of Islands County.								
3178–1	Okaihau	8·40	3·01	84·91	2·62	1·06	79	1882	Fair limestone.
2	,, ...	35·21	8·20	53·91	1·92	0·76	..	1882	Calcareous sandstone.
3	,, ...	35·38	7·79	53·98	1·84	1·01	..	1882	,,
4645	Russell	11·41	2·69	82·56	3·34	..	..	1887	Compact stone.
	Whangarei County.								
3063–1	Limestone Island ..	15·79	3·01	78·93	1·89	0·38	..	1882	
2	,, ..	26·32	8·41	62·40	2·16	0·71	..	1882	
3	,, ..	12·26	4·64	80·29	2·42	0·79	..	1882	
4	,, ..	25·99	7·60	63·63	2·14	0·64	..	1882	
5	,, ..	24·02	5·41	68·53	1·64	0·49	..	1882	
6	,, ..	31·40	7·41	58·91	1·82	0·46	..	1882	
3144–1	Kamo	2·11	3·64	92·83	1·42	Trace	88	1882	
2	,, ...	15·31	5·96	76·47	1·64	0·62	..	1882	
3	,, ...	6·23	2·39	88·62	2·36	0·40	81	1882	
4924	Hikurangi ..	2·67	1·01	92·76	2·96	0·60	88	1888	Excellent crystalline limestone.
5741	Maungakaramea ..	8·21	4·20	84·34	2·99	0·26	..	1890	Coherent stone.
E 170	Waipu	..	..	85·72	..	..	..	1904	
171	,, ...	..	..	89·30	..	..	..	1904	
172	,, ...	..	..	79·29	..	..	..	1904	
173	,, ...	..	..	76·97	..	..	..	1904	
227	,, ...	4·26	2·27	91·63	0·92	0·92	86	1905	
F 468	Otaika	9·12	1·70	86·71	..	3·22	81	1905	
B 181	Whangarei ..	20·30	5·50	69·23	2·03	2·94	59	1911	
C 318	Whangarei Heads ..	13·50	2·30	77·73	1·24	..	..	1913	
E 513	Waipu	6·64	1·80	90·04	1·52	..	83	1915	Good limestone.
E 919–1	Kamo	20·25	1·60	77·47	0·68	..	..	1915	Rather poor stone.
2	,, ...	75·59	8·42	10·88	5·11	..	..	1915	Very poor stone, of little value.
	Hobson County.								
4397	Mangawhare ..	20·30	..	73·90	1·70	4·10	..	1887	
B 508	Parakao	..	..	85·55	..	..	..	1911	
B 532	Mitiai (? Mititai) ..	..	..	65·45	..	..	..	1911	
D 1176	Arapohue	19·05	2·34	75·95	2·66	..	64	1914	Inferior stone.

ANALYSES OF LIMESTONES: NORTH ISLAND—*continued*.

Lab. No.	Locality.	Insoluble Matter (Sand, &c.).	Alumina and Iron Oxides.	Calcium Carbonate ($CaCO_3$).	Magnesium Carbonate, &c.	Moisture, &c.	Approximate Yield of Quicklime (CaO) in Calcined Limestone.	Year of Analysis.	Remarks.
	Otamatea County.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
E 310	Bickerstaffe, Whakapirau	14·70	1·10	80·76	1·14	2·30	73	1904	
F 186	Ditto	7·46	1·67	88·00	0·86	2·01	83	1905	
187	,, ...	5·18	0·90	92·86	..	1·06	89	1905	
188	,, ...	20·95	1·50	74·25	..	3·30	65	1905	
E 159–1	Ruawai	9·72	2·12	87·79	..	0·38	80	1914	Fair stone.
2	,, ...	2·97	0·90	96·02	..	0·11	93	1914	High-grade stone, suitable for calcining.
	Rodney County.								
1203	Mahurangi ..	14·75	0·81	82·20	2·24	..	..	1878	Hard, subcrystalline stone.
2053	,, ..	23·60	6·80	64·50	5·10	..	..	1878	Moderately hard stone.
3087	,, ..	21·16	4·58	68·78	2·29	3·19	..	1882	
3110–1	Warkworth ..	19·89	2·20	74·37	2·44	1·10	..	1882	
2	,, ..	51·60	..	44·10	..	4·30	..	1882	Clayey marl.
3727	Kaipara	19·42	1·24	73·16	1·72	4·12	..	1884	
5357–1	Mahurangi ..	23·96	1·24	67·16	2·03	5·61	..	1890	
2	,, ..	18·91	4·26	68·93	1·70	6·20	..	1890	
B 282	Kaipara District ..	17·48	4·62	73·00	1·27	3·63	64	1912	
	Waitemata County.								
3845	Wade	20·21	2·64	70·19	1·98	4·98	..	1884	Argillaceous limestone.
L 701	Kaukapakapa ..	38·24	7·56	46·65	Trace	6·95	..	1910	
A 1074	,, ..	..	..	73·75	..	..	..	1911	
B 162	Redvale	..	..	44·70	..	..	..	1912	
D 947–1	,, ...	16·48	2·26	79·28	1·98	..	68	1914	Second-class limestone.
2	,, ...	21·33	3·10	73·82	1·75	..	61	1914	,,
3	,, ...	29·64	3·16	65·98	1·22	..	52	1914	Interior limestone.
4	,, ...	16·54	1·94	81·01	0·51	..	70	1914	From same locality as D 947–1.
970	,, ...	47·35	8·33	42·46	1·86	..	30	1914	Very poor limestone.
1204	Silverdale ..	21·31	3·17	74·05	1·47	..	61	1914	Inferior stone.
E 393	Waitemata ..	14·10	1·86	83·91	0·13	..	74	1915	Rather poor stone.
	Manukau County.								
1595	Big Muddy Creek ..	16·93	1·80	78·86	2·41	..	..	1874	Hard fine-grained stone.
E 637–1	Whitford	28·31	2·38	69·13	0·18	..	..	1915	Inferior stone.
2	,, ...	39·67	4·94	53·56	1·83	..	..	1915	,,
F 7	Papakura	7·23	1·64	91·00	0·13	..	85	1915	
G 50	Clevedon South ..	13·84	2·75	82·18	1·23	..	72	1915	
	Coromandel County.								
6571	Kuaotunu, Urewera	3·02	1·79	92·30	2·78	0·11	87	1893	Excellent stone.
973	Torehine, Coromandel	10·20	3·00	75·70	1·90	0·20	..	1908	
1074	Amodeo Bay, Coromandel	..	..	94·30	..	..	..	1908	
1358	Cabbage Bay, Coromandel	3·50	2·30	91·90	1·60	0·70	87	1908	
	Raglan County.								
5728	Raglan	..	..	82·30	3·6	..	..	1890	Calcareous mudstone 10·9 per cent. clay; 3·2 per cent. iron-pyrites.
5613	,, ...	11·87	1·03	84·75	2·35	..	..	1890	Compact limestone.
H 29	,, ...	..	..	41·00 (?)	..	..	..	1907	
30	,, ...	..	..	30·00 (?)	..	..	..	1907	
251	,, ...	..	..	94·45	..	..	..	1907	
252	,, ...	..	..	35·14	..	..	..	1907	
253	,, ...	..	..	88·14	..	..	..	1907	
254	,, ...	..	..	61·35	..	..	..	1907	
K 2178	,, ...	..	..	69·80	..	..	..	1909	
A 11–1	Waingaro District ..	..	..	83·91	..	..	..	1911	
4	,, ..	..	..	63·54	..	..	..	1911	
B 604	Onewhero ..	8·74	2·05	85·74	..	..	..	1912	
C 984	,, ..	47·92	3·65	45·49	..	..	..	1913	
D 686	Opuatia	45·38	5·46	39·18	3·70	6·28	25	1914	Very poor limestone.
E 227–1	Karamu	46·22	3·20	47·33	..	3·25	..	1915	Inferior stone.
2	,, ...	44·80	3·16	48·37	..	3·67	..	1915	,,
3	,, ...	10·31	1·42	88·14	..	0·13	81	1915	Fair stone, suitable for grinding.

ANALYSES OF LIMESTONES: NORTH ISLAND—*continued.*

Lab. No.	Locality.	Insoluble Matter (Sand, &c.).	Alumina and Iron Oxides.	Calcium Carbonate ($CaCO_3$).	Magnesium Carbonate, &c.	Moisture, &c.	Approximate Yield of Quicklime (CaO) in Calcined Limestone.	Year of Analysis.	Remarks.
	Raglan County—ctd.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
E 1544–1	Waingaro	36·38	3·80	57·46	2·36	..	40	1915	Inferior stone.
2	,, ...	42·16	3·84	51·95	2·05	..	35	1915	,,
3	,, ...	48·29	4·10	45·14	2·47	..	..	1915	,,
4	,, ...	2·04	0·32	97·38	0·26	..	95	1915	First-class stone.
	Waikato County.								
B 974	Huntly	5·00	1·20	91·67	..	..	87	1912	
D 1035	,, ...	40·73	3·50	54·91	0·86	..	40	1914	Very poor stone.
	Waipa County.								
J 524	Ngaruawahia ..	50·00	4·80	..	0·39	..	28	1908	
525	,, ..	44·75	11·20	..	0·04	..	26	1908	
	Kawhia County.								
J 150	Kawhia	2·21	0·80	93·21	0·15	..	94	1908	
C 998	Koropupu, Kawhia	..	..	30·72	..	..	..	1913	
E 1216	Hauturu	18·12	1·82	79·51	0·556	..	70	1915	Rather poor stone.
G 233–1	Te Rauamoa, Kawhia	44·59	2·76	51·66	0·99	..	..	1915	
2	Ditto	47·18	2·54	49·83	0·45	..	..	1915	
3	,, ...	48·05	3·28	42·96	5·71	..	..	1915	
4	,, ...	4·58	0·40	87·71	7·31	..	80	1915	
G 228	Oparau	3·61	0·96	95·26	0·17	..	92	1915	
	Awakino County.								
2912	Mokau River ..	3·36	3·15	90·43	2·82	0·24	85	1881	Semi-crystalline stone.
5394–1	Mokau	5·21	3·49	88·09	2·97	0·24	80	1809	Compact limestone.
2	,, ...	62·20	..	33·90	..	3·90	..	1890	Calcareous sandstone.
7020–1	Mokau and Mount Smart	7·11	2·21	88·05	2·39	0·24	80	1896	Fine-grained stone.
2	Ditto	10·24	2·91	83·93	2·68	0·24	78	1896	Large-grained stone.
3	,, ...	22·00	2·19	73·17	2·46	0·18	..	1896	
8558	Mahoenui	7·33	1·50	87·41	3·64	0·12	80	1899	Matrix of subcrystalline limestone cementing some small pebbles.
9027	Awakino, Mokau ..	1·80	0·81	96·12	1·16	0·11	93	1901	Hard crystalline stone.
9026	Mokau	37·60	15·40	40·30	3·11	3·59	..	1901	Hard compact limestone.
	Waitomo County.								
5035	Te Kuiti	0·69	0·34	95·35	3·62	Trace	92	1889	Compact. Remarkably pure.
6846–1	,, ...	2·14	1·86	92·66	2·76	0·58	88	1895	Subcrystalline.
2	,, ...	2·37	1·72	92·34	2·94	0·63	88	1895	,,
6988	,, ...	2·29	1·79	92·78	2·93	0·21	89	1896	,,
7302	,, ...	1·63	2·03	93·24	2·99	0·11	89	1896	Compact sandstone.
G 238	,, ...	3·51	1·00	95·15	0·34	..	91	1915	
	West Taupo County.								
B 435	Taumarunui ..	..	..	66·10	..	..	..	1911	
	Clifton County.								
8473–1	Waitara	0·85	0·49	95·92	2·63	0·11	93	1899	Highly crystalline.
2	,, ...	0·74	0·43	96·20	2·49	0·14	93	1899	,,
	Stratford County.								
5687	Stratford	30·21	1·48	65·33	2·98	..	..	1891	Fossiliferous limestone.
9561	Midhirst	12·80	3·80	79·10	0·80	3·50	..	..	
	Patea County.								
3298–1	Waverley	..	..	67·40	..	..	..	1883	Marl.
2	,, ...	..	..	66·60	..	..	..	1883	,,
3369	,, ...	35·60	1·24	60·27	2·47	0·42	..	1883	Shell limestone (inferior).
	Wanganui County.								
C 1137	Wanganui ..	..	..	51·00	..	..	..	1913	
	Rangitikei County.								
B 77	Marton	6·50	0·40	91·10	1·70	0·30	85	1900	
78	,, ...	0·80	Trace	98·90	0·30	..	98	1900	
G 45	Bull's	14·83	2·64	80·11	0·56	..	71	1906	
A 324	Ohutu	..	..	91·11	..	..	..	1911	
G 49	Utiku	6·97	0·08	75·11	4·09	13·75	79	1915	

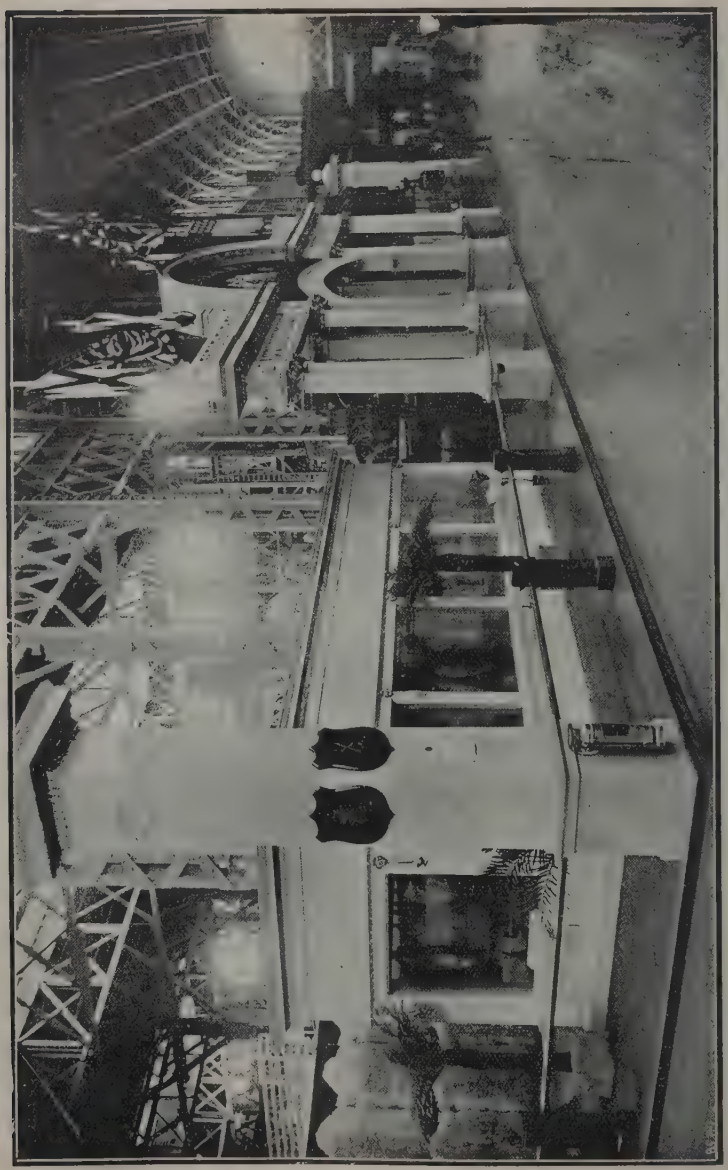
ANALYSES OF LIMESTONES: NORTH ISLAND—*continued.*

Lab. No.	Locality.	Insoluble Matter (Sand, &c.).	Alumina and Iron Oxides.	Calcium Carbonate ($CaCO_3$).	Magnesium Carbonate, &c.	Moisture, &c.	Approximate Yield of Quicklime (CaO) in Calcined Limestone.	Year of Analysis.	Remarks.
		Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
	Pohangina County.								
1964	Pohangina Valley ..	..	..	73·20	..	..	..	1909	
E 386–1	Apiti	41·14	3·80	52·60	2·46	..	..	1915	Inferior stone.
2	,, ...	23·02	1·84	74·43	0·71	..	62	1915	Poor stones.
3	,, ...	22·01	2·00	75·86	0·13	..	64	1915	,,
F 6	,, ...	32·68	2·18	63·11	2·03	..	50	1915	
	Oroua County.								
K2952	Makino	12·00	2·92	83·57	1·00	..	74	1909	Shelly rock.
	Woodville County.								
G 292A	Woodville	16·02	1·40	80·89	0·48	..	72	1906	Rock limestone.
292B	,, ..	13·10	0·49	85·78	..	..	78	1906	Fossil-shell limestone.
A 223	Near Woodville ..	..	..	80·70	..	..	..	1911	
C 114	Manawatu Gorge ..	15·39	2·18	79·44	..	..	..	1913	Similar in texture to Mauriceville stone, but latter is higher in calcium carbonate.
G 229	,, ..	13·30	2·38	83·91	0·41	..	75	1915	
	Pahiatua County.								
4863	Pahiatua	18·21	2·22	74·97	2·96	1·64	..	1888	Calcareous freestone.
K 233	,, ...	3·64	1·84	89·46	2·25	..	82	1909	
C 945–1	Ballance District ..	6·71	1·87	87·86	1·19	2·37	83	1913	
2	,, ..	10·81	3·21	82·95	0·85	2·18	75	1913	
3	,, ..	9·08	3·01	85·63	0·83	1·45	78	1913	
4	,, ..	3·45	0·96	92·53	0·69	2·37	90	1913	
E 490	Pahiatua	1·30	0·32	96·80	1·58	..	97	1915	First-class agricultural limestone.
673	,, ...	14·16	1·90	78·83	5·11	..	..	1915	Rather poor stone.
	Eketahuna County.								
5985	Newman (No. 1 Settlement Block)	36·24	1·69	59·03	2·78	0·26	..	1892	Shelly limestone.
	Mauriceville County.								
4343	Mauriceville ..	2·71	10·00 Al_2O_3	84·19	2·98	0·14	78	1886	Shelly limestone (trace of manganese).
4928–1	,, ..	..	..	93·14	..	..	..	1888	
2	,, ..	..	..	91·96	..	..	..	1888	
5660	Mauriceville (near Brook Quarry)	4·22	2·41	90·23	2·87	0·27	83	1890	
7272	Mauriceville ..	3·19	2·34	91·98	2·18	0·31	87	1896	Occurs as coarse sand with small nodules.
7808–1	,, ..	8·64	2·16	85·93	2·98	0·29	79	1897	Buff-coloured stone.
2	,, ..	3·79	3·14	89·71	3·16	0·20	83	1897	Red stone.
3	,, ..	10·31	2·63	84·16	2·69	0·21	77	1897	Bluish stone.
9393	,, ..	..	..	92·30	..	..	..	..	
9447	,, ..	26·00	1·00	71·50	..	1·50	..	1903	
K 1107	,, ..	1·98	1·16	91·26	1·95	..	85	1909	
L 479	,, ..	3·82	4·78	90·63	0·32	0·45	85	1910	
480	,, ..	1·88	2·86	94·41	0·25	0·60	91	1910	
G 279	Mangamahoe ..	13·81	2·72	80·16	3·31	..	69	1915	
	Masterton County.								
4946	Masterton ..	18·40	0·61	76·41	2·84	1·74	..	1888	Sandy limestone.
9198	Bushcroft, Masterton	47·70	6·50	42·50	1·50	1·30	..	1901	Manganese dioxide = 0·5 per cent.
J 549	Masterton ..	1·16	0·40	95·39	0·68	..	96	1908	
550	,, ..	18·21	0·10	80·17	0·49	..	71	1908	
551	,, ..	22·26	2·60	74·39	0·03	..	63	1908	
552	,, ..	15·44	1·44	81·11	0·65	..	72	1908	
D1026–1	Awatoitoi, Masterton	37·68	4·05	56·48	1·79	..	42	1914	Very poor stone.
2	,, ,,	21·55	4·00	72·92	1·53	..	60	1914	Inferior stone.
	South Wairarapa County.								
711–1	Gladstone	1·60	0·80	95·90	..	1·70	95	1905	
2	,, ...	0·20	0·40	95·20	..	4·20	98	1905	
E 863	Carterton	28·56	5·12	64·26	2·06	..	50	1907	
	Featherston County.								
4920	Greytown ..	3·20	1·98	91·35	3·16	0·31	87	1888	Good stone for burning.
8351	Turanganui, Martinborough	1·69	2·01	93·37	2·69	0·24	90	1899	Hard limestone.
L 57	Pirinoa	65·72	10·00	18·56	..	..	..	1910	
58	,, ...	35·00	6·80	53·90	..	..	..	1910	
59	,, ...	6·64	1·60	89·60	..	..	84	1910	
60	,, ...	9·96	2·94	85·89	..	..	79	1910	

ANALYSES OF LIMESTONES: NORTH ISLAND—*continued.*

Lab. No.	Locality.	Insoluble Matter (Sand, &c.).	Alumina and Iron Oxides.	Calcium Carbonate ($CaCO_3$).	Magnesium Carbonate, &c.	Moisture, &c.	Approximate Yield of Quicklime (CaO) in Calcined Limestone.	Year of Analysis.	Remarks.
	Featherston County—ctd.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
61	Pirinoa	1·84	1·21	95·89	..	..	95	1910	
B 364	Featherston ..	0·50	0·28	98·27	..	..	96	1911	
D 1087	" ..	3·79	0·11	94·81	1·29	..	90	1914	First-class stone.
	Opotiki County.								
B 67–1	Opourae, Opotiki ..	..	..	97·95	..	..	..	1912	
2	" " ..	38·93	3·80	56·36	..	0·73	..	..	
	Cook County.								
1816	Mangataikapua ..	11·55	4·09	81·36	1·00	1·60	..	1909	
B 662	Gisborne	..	..	98·00	..	..	..	1912	
G 131	"	4·83	1·00	93·36	0·81	..	88	1915	
	Waikohu County.								
2075	Matawai	..	..	98·10	..	..	..	1909	
	Wairoa County.								
4464	Clyde, Wairoa ..	37·81	3·06	53·32	2·99	2·82	..	1887	Fairly soft stone.
D1216–1	Wairoa	4·42	1·00	93·65	0·93	..	89	1914	Good stone.
2	"	24·60	3·10	69·09	3·21	..	55	1914	Inferior stone.
3	"	24·46	2·40	71·24	1·90	..	58	1914	"
4	"	4·48	0·90	93·85	0·77	..	90	1914	First-class stone.
	Hawke's Bay County.								
1418–1	Pakipaki ..	4·06	1·08	93·94	0·92	..	90	1874	Soft.
2	" ..	6·12	1·79	90·98	1·11	..	85	1874	"
3	Pakipaki (20 miles distant)	4·53	1·11	92·85	1·51	..	88	1874	Shelly.
4	Te Aute	12·48	1·28	85·63	0·61	..	79	1874	Friable.
5	"	10·50	2·52	86·04	0·94	..	79	1874	Very loose.
6	Kaikoura	22·72	1·45	74·62	1·21	..	..	1874	Rubbly.
7	24-mile Post ..	8·55	1·54	88·99	0·92	..	81	1874	Rubbly with hard nodules.
8	Middle Road ..	11·81	1·56	84·87	1·76	..	78	1874	Shelly, coherent.
9	Pandora Point ..	75·98	2·91	20·71	0·40	..	..	1874	Calcareous sandstone.
10	Bluff	15·91	1·68	81·42	0·99	..	..	1874	Compact and coarse-grained.
E 124	Te Mata	18·10	1·20	76·90	..	..	69	1904	
K 1418	Hastings	..	4·44	43·75	0·72	..	..	1909	Shelly conglomerate (25 per cent. pebbles).
C 644–1	Newstead, Napier ..	..	..	90·70	..	..	..	1913	
2	" " ..	..	..	92·30	..	..	..	1913	
E 943	Te Mata, Havelock N.	10·96	1·54	87·17	0·32	..	88	1915	Shelly conglomerate of good quality.
F 173	Napier	20·22	2·03	76·53	1·22	..	65	1915	
	Waipukurau County.								
1940	Newlands, Waipukurau	1·18	0·97	94·67	2·49	0·69	..	1878	Compact brownish stone.
E 135	Hatuma	3·50	1·50	95·00	..	..	91	1904	
136	"	3·10	0·60	95·20	..	1·10	93	1904	
137	"	4·80	1·10	93·00	..	1·10	90	1904	
138	"	14·40	2·50	80·90	..	2·20	73	1904	
139	"	11·40	2·10	84·90	..	1·60	80	1904	
140	"	10·30	3·20	86·10	..	0·40	78	1904	
141	"	0·20	0·20	99·60	..	..	99	1904	
A 131–1	Mount Herbert, Waipukurau	..	0·75	96·95	..	..	..	1911	
2	Ditto	..	1·40	92·01	..	..	..	1911	
D 922	Waipukurau ..	4·39	1·82	92·76	1·03	..	87	1914	First-class stone.
	Dannevirke County.								
529	Whiteburn, near Ormondville	18·50	5·50	71·60	1·70	2·70	..	1907	
1799	Mangapuaka, Ormondville	..	..	91·40	..	..	..	1909	
L 937	Makotuku ..	9·06	2·22	87·67	Trace	1·05	81	1910	
	Patangata County.								
3374	Wanui, Cape Turnagain	25·80	7·40	66·80	..	..	..	1883	Very hard limestone.
	Akitio County.								
L'850	Pongaroa	3·32	1·48	94·60	0·70	..	92	1910	
B 567	Akitio	..	..	97·55	..	..	..	1911	

NORTH ENTRANCE TO NEW ZEALAND COURT, PALACE OF AGRICULTURE, PANAMA PACIFIC EXHIBITION.



NORTH SIDE OF NEW ZEALAND COURT, PALACE OF AGRICULTURE, PANAMA-PACIFIC EXHIBITION.

TESTS OF SPRAYING-COMPOUNDS: LIME-SULPHUR.

In continuation of the article on the lime-sulphur spray in the last issue of the *Journal*, the report on the Nelson tests by Mr. G. Stratford, late Orchard Instructor for that district, is given below. The work was arranged for by Instructor Thorpe, and, on his retirement, was continued by Instructor Stratford, in co-operation with the growers named in the appended table. The thanks of the Department are due to the gentlemen named for very valuable assistance and information.—T. W. Kirk.

THE NELSON TESTS.

During the past season various spraying experiments have been carried out in the Nelson District with several brands of lime-sulphur solution. While there is still much to be learnt with regard to this compound, the tests carried out have been very instructive, and a great deal of useful information has been obtained. Four brands of lime-sulphur were used in order to prove their powers as fungicides and insecticides. It must be remembered that last spring was very dry, and therefore unfavourable for the spread of apple-scab or black-spot, one of the chief diseases worked against. Consequently, further experiments must be carried out in order to ascertain what results can be obtained in a season more favourable to this disease. Many other factors have also to be further considered—*e.g.*, the varying specific gravities of the different solutions, the different strengths to be used on different varieties of trees to produce the best results, and the seasons when the spray should be used.

So far as the experiments this season are concerned, it may be said that they have been very successful, and there is no doubt that concentrated lime-sulphur solution is a spray that has come to stay; in fact, many growers predict that in a few years lime-sulphur will form the basis of all our spraying. Should this eventuate, spraying will be much simplified. The value of lime-sulphur as a fungicide is fully recognized, and it also reduces the russeting of fruit—so noticeable with Bordeaux mixture—to a minimum. No one would think of underestimating the value of Bordeaux as a fungicide, and there are seasons when it is recommended to be used; but the russeting of apples and pears caused by Bordeaux during the spring and summer makes it almost imperative that another spray should, if satisfactory, be used in its place. This place has been filled by lime-sulphur, as the experiments carried out this season plainly show.

Much has to be learnt about lime-sulphur as an insecticide, and until that is done it is not advisable to stop spraying with red oil during the dormant season for the control of scale, woolly aphis, red spider, &c. As regards powdery mildew, which is gradually on the increase in almost all districts, I am sure that lime-sulphur is the only spray we have so far that will combat it successfully: exactly at what season or at what strength still remains for further trial. One of the peculiarities of the season's experiments is the fact that all the brands used appeared to do equally good work in spite of the different densities of the liquids, but probably this was on account of the unfavourable season for the spread of fungus diseases.

In the experiments carried out a marked difference was noticed in the foliage of the trees sprayed with lime-sulphur as compared with the trees left unsprayed as a check. Where lime-sulphur had been used the trees "stood out" by themselves, the foliage being much larger, darker green, and more vigorous; while the growth made on the same trees was much in excess of that of those sprayed with Bordeaux mixture or left as a check.

The strengths at which the tests were made were 1–60, 1–80, 1–100; three of the brands used tested 33° Beaume and one 23° Beaume. On apple-trees that were sprayed at 1–60 no damage was done either to fruit or foliage, and the fruit was kept almost entirely free from scab, while powdery mildew was decidedly checked. Trees sprayed at 1–100 only developed a few "spots" towards the end of the season. This strength also did good in checking powdery mildew. Practically no russeting occurred at any of the strengths—in fact, the colour of the fruit appeared to be increased. From close observation of the experiments this season it would appear that to get the best results from the use of lime-sulphur the first spraying should be given as soon as the blossoms are opening in the spring, followed by two or more sprayings —according to the season—at intervals of about a month. There is no doubt that some trees will stand a much stronger spray than others, tender varieties like Jonathan and Cox's Orange Pippin being very susceptible to spray injury. In view of this fact it is advisable, until further tests are carried out, to be on the safe side, using the lime-sulphur at the strength of 1–80 rather than 1–60; indeed, taking the past season's tests as a guide, splendid results have been obtained at 1–100. This was specially noticeable on one Cox's Orange Pippin sprayed at Mr. G. Dee's orchard, Stoke, where two sprayings were given at 1–100. This tree was by far the best in the orchard, being absolutely free from spot, mildew, russeting, or cracking, and the fruit was much larger and better coloured than on any other tree of its kind.

As regards the pear-trees sprayed, another season is required before anything very definite can be stated. One peculiarity was the fact that although the pear-trees were quite clean and healthy after two sprayings, the third spraying burnt the foliage considerably.

On the following pages is a list of trees sprayed, dates, strengths used, and results obtained.

NELSON DISTRICT TESTS OF LIME-SULPHUR SPRAY.

Variety of Tree, &c.	First Application and Results.	Second Application and Results.	Third Application and Results.	Strength used.	Final Results.
Sturmer. Sprayed with red oil during winter. Spot bad previous season, also mildew. (G. Dee and S. Rowe, Stoke)	8/10/14. Blossoms showing pink; mildew on some blossoms. Inspected 23/10/14: Young leaves burnt tips; foliage speckled; tree in poor condition.	6/11/14. Fruit set well; tree well recovered from effects of first spraying; no spot showing; mildew improved. Inspected 17/11/14: No damage done	Not applied, as trees were quite clean	1–60 1–80 1–100	Inspected 11/2/15. Splendid results. Very good; no russeting. Few spots showing. No damage at any strength.
Apple of Commerce. Sprayed as usual in winter. Trees in good condition. Spot bad previous season, also mildew. (G. Dee, Stoke)	8/10/14. Few blossoms open; rest showing pink. Inspected 23/10/14: Leaves and blossoms burned badly; fruit not setting on trees sprayed 1–60	9/11/14. Black-spot showing on leaves and on odd apples. Inspected 17/11/14: Slight burning pparent; leaves falling somewhat; no spot	Not applied. Fruit clean; foliage slightly scorched	1–60 1–80 1–100	Inspected 11/2/15. Fruit good; no spot; slight burning of foliage. Good; free from scab; very little mildew. Few apples affected with scab; fruit good; small crop.
Cleopatra. Trees sprayed as usual in winter. Lost all fruit previous season through scab. Powdery mildew very bad; trees in poor condition. (G. Dee, Stoke)	8/10/14. Well in bloom; mildew bad. Inspected 23/10/14: No damage; mildew retarded and looking dried up	23/10/14. Fruit setting well; no black-spot. Inspected 17/11/14: No damage; little black-spot on leaves; mildew persisting; foliage strong and healthy	19/11/14. Black-spot on leaves; none on fruit; mildew still persisting. Inspected 3/12/14: No damage; trees looking very healthy; mildew checked	1–60 1–80 1–100	Inspected 11/2/15. No scab showing, and very little mildew; foliage very healthy and vigorous. No spot, and no damage done; trees good; no russeting. Little spot, but nothing to be compared with last season. Trees much better than where sprayed with Bordeaux mixture.

NELSON DISTRICT TESTS OF LIME-SULPHUR SPRAY—*continued.*

Variety of Tree, &c.	First Application and Results.	Second Application and Results.	Third Application and Results.	Strength used.	Final Results.
London Pippin. Sprayed with Gargoyle in winter. Bad with mildew and septoria previous season. Light crop. (F. Childs, Stoke)	13/10/14. Good show of blossoms; mildew slightly. Inspected 10/11/14: No damage; no increase of mildew	10/11/14. Fruit set well; foliage healthy. Inspected 4/12/14: No damage; no spot; trees healthy	4/12/14. Trees healthy. Inspected 2/1/15: No damage; mildew on tips of foliage	1–60	Inspected 12/2/15. No spot; foliage healthy; powdery mildew slightly; no russeting.
				1–80	Trees good; no spot.
				1–100	Good; no russeting; mildew slightly on tips.
Jonathan. Sprayed with oil in winter. Bad with mildew previous season; no spot. (E. B. Izard, Stoke)	12/10/14. Trees in full bloom; bad with mildew. Inspected 23/10/14: Strong, decided check to mildew	9/11/14. Trees in full leaf; no damage; foliage healthy. Inspected 4/12/14: Result satisfactory; no damage	4/12/14. Trees healthy; no spot. Inspected 2/1/15: No damage; no spot; mildew much better	1–60	Inspected 11/2/15. Very good; trees vigorous, healthy, and greener than check trees.
				1–80	Results good; no spot or mildew.
				1–100	Good; no russeting.
Dougherty. Sprayed as usual during winter. (Allport and Scott, Stoke)	10/10/14. Trees just coming into blossom. Inspected 10/11/14: Foliage healthy; no damage; good crop showing	10/11/14. Trees in full leaf; fruit set well. Inspected 4/12/14: Fruit clean; no damage	4/12/14. Trees healthy; no spot. Inspected 2/1/15: Good results; trees clean	1–60	Inspected 23/2/15. Fruit clean; on trees sprayed with two brands; others showing a little spot.
				1–80	Results good; black-spot showing slightly with two brands.
				1–100	No russeting; little more spot with two brands. All trees much better than check-trees, which showed considerable spot.

Cox's Orange Pippin. Sprayed as usual in winter. Mildew bad last season. (Allport and Scott, Stoke)	10/10/14. Trees well out in blossom; mildew bad. Inspected 10/11/14: No damage; mildew checked	10/11/14. Foliage good; fruit set well. Inspected 4/12/14: Slight burning on leaves at 1–60 and 1–80	Not applied third time: trees showing last spraying	1–60 1–80 1–100	Inspected 23/2/15. Trees good; fruit clean; slight burning on leaves. Slight burning; mildew checked. Practically no burning; trees much healthier; results good.
Delicious. Sprayed as usual during winter. (Allport and Scott, Stoke)	12/10/14. Just coming into blossom. Inspected 10/11/14: No damage; trees very clean	10/11/14. Trees healthy; fruit well set. Inspected 4/12/14: Fruit very clean; good crop	4/12/14. No spot showing. Inspected 2/1/15: Results good	1–60 1–80 1–100	Inspected 23/2/15. Splendid results. No spot; trees healthy. Fruit clean; healthy foliage.

NOTE.—Twelve trees of each of the above varieties were sprayed in lots of four at the strengths specified in the fifth column. The brands of lime-sulphur used in each case were Sherwin Williams's, Rogers's, Hall's, and "Whakatu."

CHECK-TREES.

Delicious: Black-spot slightly. *Dougherty:* Black-spot bad on fruit and foliage. *Cox's Orange Pippin:* Traces of mildew, otherwise good. *Jonathan:* Not nearly so healthy or vigorous as those sprayed with lime-sulphur. *Sturmer:* Trees much worse than those sprayed; fairly bad with black-spot. *Apple of Commerce:* Black-spot bad; trees looking very unhealthy. *London Pippin:* Tree appeared as good as those sprayed, except that some of the tips were mildewed. *Cleopatra:* Black-spot appeared, so the tree was sprayed.

TREATMENT OF GARDEN SOILS.

W. H. TAYLOR.

It is accepted as a maxim that good results in gardening cannot be looked for from a soil deficient in humus. In the absence of decomposed organic manure, green-manuring is frequently advocated. It must be clearly understood, however, that, like other excellent practices, green-manuring should be resorted to only when judgment indicates it to be advisable, and not indiscriminately. The digging-in of large quantities of weeds, or even a green crop specially grown, may be harmful. Soil does not require the green crop if it has already sufficient humus. If clay soil or light-brown loam becomes too light in colour or sets quickly after rain, it is a sign of deficiency of humus. But while it works well, and does not run together, it may be assumed that humus is not wanting. In such cases a fallow will be of much greater benefit than green-manuring.

The fallow is a very old institution. Practical experience is unanimous on the advantages that accrue from exposing soil to the atmosphere. If the soil is possessed of a fair supply of humus, but is poor otherwise, it is vastly restored to fertility by being kept clean and exposed to the atmospheric conditions for a period. I have at present vegetables growing well on soil so treated. Among others are spinach and winter rhubarb, on soil that has had no animal manure for years, and no green manure for at least two years. The ground was fallowed during the past summer, and given bone-and-blood manure—2 oz. per square yard.

One manner in which green-manuring may be harmful is by harbouring insect pests. Slugs and snails cannot be cleared out except by keeping the ground clean. A mass of decaying matter of this kind gives an unstable seed-bed, and losses may follow sowing small seed on it if it has not settled down. It is important that green crops be covered long enough to rot before sowing seed on the ground, for it has been proved that gases emanate from the stuff during the early stages of decay that are inimical to the germs of seeds, hence apparently unaccountable losses may occur.

It has been pointed out on previous occasions by the writer that the best possible way to dispose of perishable garden refuse is by trenching it in. When such stuff is buried deeply it can do no harm, and it keeps the subsoil open, while at the same time encouraging the roots of plants to go down to it. Thus in summer-time plants may flourish in spite of heat and drought. On the other hand, during wet weather the water sinks at once to a low level, and the upper stratum is kept sweet, enabling plants to thrive in winter. When soil so treated is again trenched, as it should be when the top soil has been cropped for several years, the decayed vegetable matter is brought to the top, and is of great value.

Note that stuff of a woody nature should never be put in the soil: burn it and use the ashes. It has been my practice for many years to put a supply of wood-ashes under cover every winter to be used for onions and asparagus particularly, also for fruit-trees and bushes when there is any to spare. Wood-ashes are rich in potash, which is bleached out by rain, for which reason they should be put under cover before rain falls on them.

THE DEPARTMENT'S FARMS.

THE control of the Waerenga, Tauranga, and Arataki Experimental Farms, which are mainly devoted to fruitgrowing and viticulture, has been transferred from the Fields Division to the Horticulture Division of the Department. These places are now designated "horticultural stations" instead of "experimental farms." The name of the Waerenga establishment has been altered to Te Kauwhata, its full designation thus being Te Kauwhata Horticultural Station. The Ruakura, Weraroa, and Moumahaki Farms remain under the control of the Fields Division as hitherto.

Propagation of the selected "Moumahaki" prairie-grass is being much extended. Several acres have been sown this spring for seed purposes at the Moumahaki Experimental Farm.

Last season's large mangel crop at Ruakura is being very profitably used. The ewes and lambs have done well on mangels as supplementary feed, and prefer them to swedes, as also do the pigs.

WATER-GRASSES.

R. J. HAMILTON, M.A., B.Sc.

MANY low-lying lands are of little use because the frequent floods kill off any grasses that may be sown. There are, however, several grasses that will remain alive under water for weeks or even months and then grow all the better for the rest. I give below the results of observations and experiments carried on with several grasses. The most useful grasses for wet and flooded lands are *Paspalum dilatatum, Paspalum Digitaria, Poa aquatica, Glyceria fluitans,* and *Lotus major.*

I have already written fully on *Paspalum dilatatum* in a former issue. It will stand water for weeks and then come away strong and vigorous.

Paspalum Digitaria grows freely along the Waikato River and in the numerous islands in its course. It is dormant in the winter, but throws an immense amount of feed in spring and summer. It throws out long jointed stems which root wherever they touch the earth. The plants have to be propagated by means of cuttings, as the seed does not germinate very well. The grass will live for six months under water, and when the water starts to go down will grow vigorously. The leaves are sweet and juicy, and cattle eat both leaf and stem with great relish. It is very nourishing, and some of the best butter-fat-producing paddocks are those in which this grass predominates.

Poa aquatica is a rank grass that throws a great amount of feed, which, however, is somewhat dry and little suited for dairying though good for fattening. It will grow for months under water and then come away with great vigour. The leaves look like young raupo-leaves and resemble them in general structure, but are much more nourishing. The plant grows best in rich swamps and spreads both from seed and from the roots. It puts out long vigorous underground stems which throw up a shoot from every joint. This grass does well in all parts of the Waikato.

Glyceria fluitans is a kind of rice-grass. Its leaves are a dark green in colour, sweet to the taste, and much relished by cattle. The grass will live in water for months, but grows best in low-lying flats which are occasionally flooded. It is not as vigorous as *Poa aquatica*, but spreads much more rapidly than any of the

other grasses. The plant will soon take complete possession of any open spaces in a swamp. It must, however, be given a fair start. It tends to choke up watercourses, but is a valuable grass, as it is good for both fattening and dairying. It stands frost well, and may be seen floating on the surface and looking green and vigorous even during the coldest weather. I should think that it would do well even in very cold climates.

Lotus major is also a valuable grass for swamp land. It grows vigorously and throws out an immense amount of feed. It is much relished by stock, and spreads so rapidly that a sowing of even half a pound to the acre will soon make a good showing. It will live under water for weeks, and then throw out long shoots which spread over the tops of rushes and other swamp vegetation.

Fiorin is also a good grass for low-lying land. It throws a fair amount of feed which cattle seem to relish. It will not, however, grow in very wet land.

All the above grasses should be sown in the beginning of summer when the swamps are drying up. Of the grasses mentioned above *Glyceria fluitans* and *Poa aquatica* will stand most water. The former prefers a clay bottom, whilst the latter does very well in peaty soil. *Paspalum Digitaria* is a valuable grass for pit-holes and low-lying places which would otherwise be full of docks and rubbish. It grows vigorously in the driest summer and converts otherwise useless areas into a valuable standby for droughts. *Paspalum dilatatum* will not stand as much water as any of the foregoing, but will stand more than any of the common grasses.

DOMINION FARMERS' INSTITUTE.

A PROJECT of great potential usefulness for the agricultural industry of New Zealand—the establishment of a Dominion Farmers' Institute in Wellington—has recently been launched. The proposed institute is intended to be a connecting-link between the various farmers' organizations and interests. It would provide headquarters for several bodies, and much-needed conference accommodation. A farmers' club and private hostel are also included in the scheme. It is purposed to build on a well-situated central site over which an option has been secured. The proposed directorate of the "Dominion Farmers' Institute (Limited)," with which title the enterprise is to be registered under the Companies Act, is headed by Sir James G. Wilson, and, together with the provisional council, it includes the names of many leading men in the agricultural industry and farmers' co-operative organizations.

The young Weraroa Holstein and milking-strain Shorthorn bulls coming on for the annual sale are doing well, and form an exceptionally nice lot of yearlings.

WORK FOR THE COMING MONTH.

NEW ZEALAND is a country of wide variation in climatic and soil conditions. In applying suggested procedure it is, therefore, necessary for the farmer to amend it to suit local weather-conditions and the requirements of his soil—information which can best be ascertained by a study of these problems on the part of the farmer himself. Nothing can take the place of local knowledge. Little advice on an agricultural subject is capable of general application in its entirety.

THE FARM.

J. DRYSDALE.

FEEDING-OFF cannot be carried out with the late sowings of oats and wheat, and no delay to the growth of these crops should be allowed. It will be an advantage in many cases to harrow, and roll afterwards. This operation firms the roots of the young plants, particularly where frosts have been experienced, while also conserving the moisture and preparing the surface for reaping. It will also give the plants more support to withstand the wind and prevent them from lodging.

A small area should be prepared and sown with rape for topping off forward lambs. In many cases a field of young grasses with a mixture of oats or barley, also ½ lb. rape per acre, will give better results than rape alone, particularly in showery weather. The tillage of such a field, however, must have been equal to that for rape.

The main crop of potatoes should be planted at the beginning of the month. If stable manure is used and has not been already ploughed under, it should be disked in as early as possible. On no account should the manure come in contact with the tubers; this also applies to heavy dressings with ordinary manures. Half the quantity should be worked into the soil previous to planting. Plant the best tubers of the variety used. If more attention was given to seed-selection better results would be obtained as regards both quantity and quality. With all animal and plant life good constitution is necessary to promote and retain a healthy and vigorous growth.

Pastures for hay should be closed up. Top-dressing with superphosphate and harrowing, although now rather late, will stimulate the growth and induce maturity in the shortest time possible, which means that the use of the field for grazing is regained early.

Attention should be given to areas set apart for turnips, mangels, and carrots, and weeds should not be allowed to take possession. The best method of cultivation to follow will depend a good deal upon the history and condition of the field. Areas that are proposed to be put under crops—root crops especially—should be decided upon the previous year, in order to allow time for proper cultivation, so that the condition of the soil when seeding-time arrives will be of the best.

The farmer who has the right stamp of mare for breeding should attend stallion parades and select the best stallion for his purpose. Early foals are the best; late foals are always a drag through the winter. Farmers' unions might well give more attention to this matter; it would be to their interest to make season arrangements for a good class of horse to travel their respective districts.

Reports are to hand from several quarters that a number of the oldest and best-conditioned lambs in the flocks have been found dead. This is doubtless due to congestion of the kidneys resulting from plethora, and the condition and treatment have been described by the veterinary authorities. A post-mortem shows the kidneys to be soft and pulpy in appearance, and totally incapable of performing their normal functions. The condition is brought about through over-nutrition of the lambs. It is almost invariably single lambs which suffer, they having available the same quantity of milk which in the case of twins has to be shared between two. The remedy is simple—the relief of the plethoric condition of the body by bleeding, and this can be done by cutting and tailing the lambs as soon as indications of the trouble in the flock are noted. As a further precaution it is well when docking single fat lambs (particularly those with the ewes on rich pasture) to leave the tail double the usual length, so as to allow for a further tailing to be done later. Tail with the knife and allow the lamb to bleed freely. Apart from this particular trouble there is no objection to the use of the searing-iron, but if proper precautionary measures are taken there is no necessity for the use of the iron. If temporary hurdles are erected in the corner of a clean paddock and the operator understands his business, using two knives dipped occasionally in a disinfectant, the risk from blood-poisoning is reduced to a minimum.

SOUTH ISLAND NOTES.

W. J. McCULLOCH.

October will find the farmer still busy, although the mild open winter followed by like conditions with the advent of spring has greatly aided the progress of cultural and other operations on the

farm. The partial failure and consequent shortage of many of the root crops this past season in the northern districts of the South Island has emphasized the necessity of providing some supplementary green fodder crop for late winter and early spring feed. However, given average weather-conditions grass should now be sufficiently well advanced in most districts to keep stock going.

Dealing with pastures, it is very noticeable in the South Island that many farmers absolutely neglect to give the grass an occasional stroke of the harrows, and it is quite a common thing to find the small handy paddocks — about the homestead especially — closely studded with manure-droppings. A stroke of the harrows, tripod for preference, will distribute the manure evenly to the advantage of the whole field as well as freshen up the roots of grasses by breaking any crust that may have formed upon the surface.

Oats may be sown as late as the middle of the month in southern districts, although earlier sowing is much to be preferred, and seeding should be thicker as the season advances. In many cases the later areas can be used for chaffing, for which purpose the varieties of blacks, duns, Algerians, &c., are suitable.

Barley may still be sown early in the month in favourable localities, but not in districts subject to damp weather in the autumn. This is a most troublesome crop to harvest where the weather is uncertain, for if not saved in good condition it is liable to become discoloured and unfit for malting purposes. Speedy ripening and dry harvesting cannot always be attained, but late sowing in late-ripening districts greatly increases the chances against the proper saving of the crop. Sharp, warm soil should be chosen for this cereal, and the later-sown crop should receive thicker seeding.

Potatoes may be planted, but where there is danger of frosts the operation had better be deferred until the end of the month or beginning of November. A good deep loam well worked out of old pasture is to be preferred, and if farmyard manure can be added so much the better. Seed should be carefully picked over, discarding anything smaller than a hen's egg, and whole seed is to be preferred. All seed should be selected from a crop which was free from disease.

Mangels should be sown during the month. This root is indispensable to farmers, especially in the warmer and drier districts where turnips do not succeed. The mangel is also freer from injury from blights and insect pests than the turnip, and, being a deeper-rooting plant, is enabled to withstand periods of drought better; thus a good deep tilth is necessary to allow the roots to penetrate. As with most other farm crops, an acre of ground thoroughly well

prepared and suitably manured will yield as much or more than two or three acres indifferently treated. Sow in drills 28 in. or 30 in. apart at the rate of 5 lb. or 6 lb. per acre, having previously soaked the seed in water for a few hours, and then sun-dried it to prevent clogging in the machine.

Field carrots may also be sown towards the end of the month, in a good, deep, fine, rich mould of a loamy or sandy nature for preference. Sow at the rate of 3 lb. or 4 lb. per acre in rows 14 in. apart to allow of intercultivation during growth. A patch of carrots should always be grown, as there is nothing better than a few once a day during winter for the working-teams of draught horses.

In cases where turnips have been fed off too late to permit of spring crops of cereals following, the ground can be utilized for rape or other green crop to be fed off about Christmas, or, if desired, it may be sown down with rape and grass. In this case do not seed the rape too heavily, otherwise the grasses may be smothered.

In sowing down land to grass there are three things upon which a good sole of grass depends—viz., (1) a deep, firm, fine tilth; (2) freedom from weeds; (3) a good seeding of a mixture most suited for the quality and character of the soil and climate. The sowing-down of grasses with cereals is gradually being superseded of late years by sowing later with rape or soft turnips, especially in the southern districts. The results of the two latter methods, generally speaking, are better, but if grass has to be sown with cereals the latter should not be seeded too thickly.

With regard to the components of the seed mixture, mention may be made of two of the mixtures that are being used in the Department's South Island experiments this year, as follows:—

No. 1. Rye-grass Mixture.—Perennial rye-grass, 18 lb.; Italian rye-grass, 7 lb.; cow-grass, 2 lb.; white clover, 1 lb., per acre.

No. 2 Cocksfoot and Perennial Rye-grass Mixture.—Cocksfoot, 8 lb.; perennial rye-grass, 14 lb.; Italian rye-grass, 5 lb.; crested dogstail, 1 lb.; cow-grass, 3 lb.; white clover, 1 lb.; alsike, 1 lb., per acre.

The fact that these are experimental mixtures implies that much has yet to be learned with regard to grassing in the South Island. At present no very definite recommendations can be made on this subject. The above mixtures are therefore quoted as suggestive to farmers who are seeding pastures this season. No. 1 mixture is calculated to furnish quick feed, but it has serious faults as a long-rotation mixture, and in many cases would deteriorate after the first year, and prove decidedly thin and poor after two years. The second mixture is a good general-purpose seeding. There is a fairly satisfactory balance between grasses and clovers, and between

the big grasses (cocksfoot and Italian) and the sward grasses (perennial and dogstail); while the cocksfoot, dogstail, and white clover should continue the productiveness of the pasture to the third and fourth years if judiciously grazed.

Lucerne can now be sown in warm districts, and towards the end of the month or the beginning of November farther south. The land should have been well prepared for this crop, with plenty of cultivation from time to time during the season, and freed of all weeds as much as possible. Particulars regarding lucerne-growing are given in a departmental bulletin.

Land for swedes should be worked up and got ready, and, as opportunity offers, land for turnips also. Cereal crops should be rolled when weather permits if this has not already been done.

Gorse and other hedges should be trimmed if this has not been attended to, and a few plough-furrows should be run along road-lines close to any hedges showing signs of spreading. It is much better policy to trim hedges once or twice a year than to have to cut back overgrown and neglected hedges and grub out plants spreading from them.

THE ORCHARD.

J. A. CAMPBELL.

SPRAYING-POINTS.

ORCHARDISTS are now about to enter upon their summer spraying campaign, on the result of which the success of the season mainly depends. Successful summer spraying means the effective control of all orchard diseases without injury to either fruit or foliage.

To effect this result the work must be thoroughly and intelligently carried out. Much of the annual damage to fruit and foliage could be avoided if all circumstances were carefully considered at the time of spraying, without lessening to any extent the effect of material used. Spray damage to the fruit itself, although possible at any stage of its growth if anything in the nature of a strong acid spray is used, usually occurs when the fruit is young and the skin tender. To avoid as much as possible the necessity of having to use strong mixtures at this stage, every attention should be given to the earlier spring sprayings, which should be applied before the trees bloom. Under such circumstances the earlier applications to the fruit itself can be made at a reduced strength to that required for later summer use.

Where many fail in their spraying, apart from the damage to the fruit, is in the manner in which the work is carried out, particularly in the lack of thoroughness, either in not properly covering all the necessary parts of the tree or in applying the spray at a force not sufficiently strong to drive it well into the fruit and foliage. This want of force plays a very important part, and is often due to the class of pump being used, but more often to the manner in which the pump and other appliances are fitted up.

In regard to pumps, what is required in a hand-pump is, of course, one that will give the maximum amount of pressure with the minimum amount of labour. There are several good hand-pumps on the market which, when properly fitted up and kept in good working-order, are quite suitable for spraying comparatively small areas. The shortcomings in this class of spraying lie not so much in the class of pump used as in the standard of repair and working-trim at which it is kept. Joints, valves, and washers provide the principal pump troubles, and should therefore be always kept in thorough working-order. Pumps of the kind referred to are easily dismantled, and repairs are readily effected. Hoses and nozzles should also receive their share of attention, and, last but not least, a directing-rod fitted with an angle nozzle, a necessary adjunct to thorough work, should always form part of the outfit. For larger areas, of course, the power sprayer is now looked upon as a necessity. The first cost of the apparatus is amply covered in a season or two in the shape of cleaner and better fruit and trees, and by the reduction in the cost of labour. The necessity of keeping this class of machine in thorough working-order applies with equal force as in the case of the hand-pump.

The length of time between the sprayings is also an important factor, and one that contributes considerably to the success or otherwise of the work. In the case of the codlin-moth, if the period between sprayings is more than three weeks a certain number of blemishes on the fruit in the form of "moth-stings" are to be expected. To what extent this may occur depends upon how long the interval really is, and to what extent the weather has weakened the spray on the fruit. If the interval is more than four weeks, more or less moth-affected fruit can be expected.

The principal pests and diseases that call for special consideration, particularly at the commencement of the season, are codlin-moth, apple and pear scab (black-spot), and powdery mildew.

CALYX-SPRAYING FOR CODLIN-MOTH.

The object of calyx-spraying is to secrete a certain amount of arsenate within the eye of the young fruit. The arsenate is

protected and held in place by the closing of the calyx, and thus acts as a kind of trap for the destruction of the young larvæ which subsequently endeavour to enter the fruit at this point. It is not intended as a direct destroyer of the grub at the time of application, as there are no moths on the wing for some weeks after the blossoming-period. To set this trap effectively it is evident that the spraying must be done before the calyx closes, otherwise the object of the work is lost; and as there are no moths about for some time after, the operation simply means a loss of time and material.

In order to fill the calyx-cup of the young fruit thoroughly a very high pressure is required, and the spray must be applied from every angle, but mainly downwards, as most of the young fruit at this stage is in a more or less vertical position. To thoroughly carry out calyx-spraying two separate sprayings are really required, one when about two-thirds of the petals have fallen, and the other after the remainder have fallen. If one application alone is depended upon, either the calyces of the first fruits to set will have closed or the later fruits will not have set. This is what is known in America as the single-spray system, and is largely practised in those localities where calyx-spraying alone is depended upon for the control of moth for the season.

To minimize the danger of scorching the young fruit at this stage it is advisable to reduce the strength of the arsenate of lead to two-thirds of that usually used for the control of moth later in the season. The mixture should be copiously applied at a high pressure and at a strength of 1 lb. of paste arsenate to 50 gallons of water; powdered arsenates to be reduced accordingly.

BLACK-SPOT.

Climatic conditions, particularly during the early part of the season when the fruit is setting, have a considerable influence on this as well as on other fungus diseases. When the atmosphere is warm and clear little trouble need be expected from black-spot, but the contrary is the case when the atmosphere is moist and muggy. Such conditions often prevail in the early spring after rains, especially during prolonged misty weather. As a preventive against outbreaks of black-spot under such adverse conditions, and in order to lessen the necessity of using strong fungicide sprays when the fruit is young and less able to stand them, thorough spraying earlier in the season is necessary. For this purpose the winter formula of Bordeaux, or commercial lime-sulphur 1 in 10 or 12, when the buds begin to swell, is recommended, supplemented by a weaker dressing of the same sprays when the buds show colour or the most advanced burst into

bloom. The strengths recommended for the later applications are —Apples, 4–5–50 Bordeaux, or lime-sulphur 1 in 30 to 1 in 35; pears, 6–7–40 Bordeaux, or lime-sulphur 1 in 20 to 1 in 25.

Where possible the use of Bordeaux mixture should be avoided after the fruit has set, except on the hardier varieties or at a reduced strength. Lime-sulphur 1 in 100 is preferable, as it is less likely to damage the fruit. Either Bordeaux mixture or lime-sulphur can be combined with arsenate of lead without increasing the liability of spray-scorching.

POWDERY MILDEW.

This disease is becoming more troublesome every season in many of the fruitgrowing districts of New Zealand. It is to be recognized by the white powdery mould on the leaf. The leaf itself is usually more or less deformed and fails to develop the normal size. The disease affects both the fruit-spurs and the tips of the young growth. The former eventually fail to develop healthy blossom-buds, and when blossoms do appear they are usually deformed. Affected young wood fails to make anything like normal growth, and usually dies back towards the end of the season. These affected tips are to be noticed during the winter by the silvery appearance of the bark. All such affected parts of the trees should be cut away as well as possible during the dormant season. Many of these are apt to be overlooked, but they should be removed after the foliage appears, when they can be readily detected.

Some varieties of apples are more subject to this disease than others. In this respect it is peculiar that many of the blight-proof varieties are very subject to attack, although the disease is by no means confined to such varieties.

The weakened vitality of mildew-affected foliage renders it very liable to spray damage. Taken together, these conditions very soon have a marked effect on the vitality of the tree, especially on those of more or less weak habit, such as Jonathan. In order to enable the tree to overcome the disease it is necessary to provide for a strong healthy growth by good cultivation, manuring, fairly heavy winter pruning, and by spraying early and frequently with some form of sulphur solution—either lime-sulphur, sulphide of iron, or atomic sulphur. The following treatment, if properly attended to, should give satisfactory results: Spray with lime-sulphur 1–80 as soon as the foliage appears. Repeat at intervals of from two to three weeks. This spray can be combined with arsenate of lead and used in the control of codlin-moth, black-spot, and mildew, and should be applied throughout the season.

THE POULTRY-YARD.

F. C. BROWN.

THE HATCHING SEASON.

OCTOBER may fairly be considered as the last month of the correct season for hatching chickens: therefore no time should be lost in hatching the required number of stock. It should be unnecessary to emphasize that chickens brought out later than October are not only difficult to rear, but they seldom grow to the required size or develop like those hatched a few weeks earlier. Not only this, but they frequently lay undersized eggs, and, not having the necessary vigour, are susceptible to all forms of disease. The late-hatched bird is practically under a severe handicap from the day the incubation process commences. In the first place the breeding-birds are not in the same vigorous condition as they were earlier in the season, with the result that the eggs produced contain germs of impaired vitality. Apart from this the late-hatched birds are mostly placed in quarters that the early-bred birds have made stale and dirty. Then, chickens brought out in the height of summer are not only subjected to trying hot summer days, but also to the cold-weather conditions often experienced in the autumn before they are sufficiently seasoned to withstand the extreme climatic change, which in most cases means giving them a set-back for life.

There are no chickens that do so well as those that are growing as the days are lengthening, and which have reached a fair stage of development before the approach of the cold, short days of the winter season. In cases where sitting-hens are depended upon, I realize the difficulty in securing broodies to enable the stock to be hatched at the right time—viz., August, September, and October. Even in the case of the heavier breeds the aim of the successful breeder is the production of non-sitting strains, and the nearer this end is approached the more difficult will it be to obtain sitting-hens in the desired hatching-period. Rather than have late-hatched stock, breeders would be well advised to adopt artificial methods. With the modern makes of incubators and brooders the work of managing these is not such an arduous matter as many people imagine. Providing a person has the ordinary amount of intelligence and receives a few lessons from a practical operator a fair success, even in the first instance, is assured.

BROODER QUESTIONS.

The successful rearing of chickens by artificial means depends on attention to numerous details, the most important of which is

preventing the little ones from becoming chilled. I am quite safe in saying that chill and its effects are responsible for the majority of brooder losses. In speaking of chill it is not to be inferred that a temperature falling below that of the desired degree is always the cause of this trouble. There are many ways in which chickens become chilled. For instance, too high a temperature is just as fatal as one too low. As to the correct temperature in the brooder-box for newly hatched chicks, the heat advised—90° to 95°, taken 2 in. from the floor of the brooder—will generally be found satisfactory, with, of course, a gradual reduction of heat after the chicks are two weeks old. This is not to say that chicks, even at a very young age, should be constantly kept in a temperature of 90°. The brooder should be constructed in such a way that the chicks can secure a variation of temperature during the day and at the same time be given an opportunity to breathe pure air. The correct degree of heat should always be maintained under the hover, but there should also be a cool place as well, where ample ventilation and light is provided.

Where chickens are kept in the one degree of heat, especially without free ventilation, they will become overforced like hothouse plants, with the result that when let out of the brooder they are highly susceptible to chill, and later on will probably die like flies. The aim of the poultryman should be to have the brooder so arranged that he can supply a little extra heat under the hover when normal conditions are prevailing, so that the chicks will be encouraged to settle down at night slightly away from the main source of heat. Then, in the event of a cold night following a hot one, or *vice versa*, the chicks are given an opportunity to move to and from the heat as instinct demands. In this connection the behaviour of the chickens at night is the best guide as to whether they are comfortable or not. If well spread out it may be taken for granted that the heat being maintained is correct. If the chickens are seen to be huddling, more heat is required. The spreading of the chicks should at all times be studied as well as the thermometer.

Apart from the usual causes of chill referred to, it is well to point out the necessity of not subjecting chickens to extremes of temperatures. For instance, on no account take the whole of the heat off the brooder during the day. A cold snap is just as likely to take place during the day as at night. It should be remembered that the old hen gives her chicks a warm-up even on the hottest days. Again, care must be taken not to allow the chicks out of the brooder too soon or to give them too much liberty when first let out into the run. They should be kept in the brooder for at least three days, then allow a run of 2 ft.

for the following three days, and increase this by degrees according to the age of the chicks and the weather-conditions prevailing. When allowed a lengthy run right away they are apt to lose their bearings, and, feeling the change of temperature, will huddle together and become chilled. Very often young chicks are inclined to huddle just when the sun's rays make their first appearance through the windows. When chickens are seen to be huddling in the runs they should be put back into the heating-chamber at once.

In artificial rearing many lessons can be taken from the mother hen. During the first few days her whole endeavour is to keep the chicks under her wings, and by imparting her body-heat to make them warm and comfortable, while at the same time they are given an opportunity to breathe the outside atmosphere. After about the third day she commences the hardening-off process, and does this by degrees. At first she only allows the chicks a very few minutes to feed and exercise, when she calls them under her body for the purpose of warming them. As they grow older, and providing the weather is favourable, the time given to exercise is extended, but on no account does she neglect to give them a warm-up when required.

With all the advancement that has been made in the artificial production of chickens nothing has yet been discovered to take the place of the natural mother, probably because, no matter what the weather-conditions are, the chicks can always enjoy under the hen that absolute uniformity of warmth demanded by them.

Returning to the question of chill, it is generally about three days after the chicks have suffered from this that its effects are observed. The most pronounced symptoms of chill are bowel troubles, droopy wings, excessive thirst, no inclination to leave the brooder or to eat. In addition there is always a tendency to huddling. The constant huddling leads to sweating, and in its train follows leg-weakness and general indications of an unhealthy condition. Once chicks become so affected there is practically no cure, and very often it pays best to wring their necks rather than try to doctor them. Prevention at all times is the one and only safe course to follow.

THINGS TO REMEMBER.

It is a sounder policy to rear a few chicks properly than many indifferently.

Don't overcrowd. Never place fifty chicks in a brooder when its correct capacity is for thirty.

Cleanliness is an important essential in all branches of poultry-keeping, but nowhere is it more important than in the brooder-house.

Once chickens receive a chill it mostly means giving them a set-back for life.

If the chickens are doing well, don't change the system of management because some one advises you to.

Vermin are bad for adult stock, but with chickens they are fatal.

Overforced chicks indicate their conditions by developing long wing-feathers, leg-weakness, long and large feet. Exercise is the prevention.

THE APIARY.

F. A. JACOBSEN.

THE main work in the apiary at this period will be to see that all colonies have sufficient stores. Now is the time when the bees use a lot of honey and pollen for breeding purposes, and if either of these is not at hand or procurable spring dwindling will set in. This means that colonies short of stores will become weak in bees, as breeding will not be prosecuted to a sufficient extent to replace the old bees dying off; hence the colony will not be at its maximum strength, as it should be, at the commencement of the honey-flow. The necessity of feeding weak stocks will thus readily be seen. Any one requiring detailed information on this matter should apply for the Department's bulletin entitled "Bees: Feeding and Feeders."

A liberal policy in connection with winter stores (30 lb. to 40 lb. per colony) has always been recommended in these notes, and bee-keeping readers who have followed this advice should be under no necessity of feeding. However, all stocks should now be examined in order to ascertain their condition. Some may want requeening, and others may be queenless; damp mats may want replacing with dry ones; and so on. It is little attentions of this kind that materially assist in maintaining the health and strength of the colonies.

Cleanliness should be a feature in apiary-management: therefore keep the bottom board scraped clean and the grass clipped short around the hives, thus allowing fresh air and sunlight to exert their beneficent influence without obstruction.

A close watch should always be kept on the brood, and any signs of disease kept strictly under observation until there is no doubt of its presence. Colonies so affected should be treated in accordance with methods prescribed in the Department's bulletin, "Foul-brood."

HOW TO TELL A POOR QUEEN.

The following points are recommended for the student's observation in the coming season:—

1. The uneven appearance of the brood illustrates that the queen does not lay regularly in every cell, but moves over the combs, laying indiscriminately.

2. More than one egg in a number of the cells is a bad sign. Frequently this condition means a laying worker, but then several eggs are often in one cell and they hatch out drones.

3. Crippled queens are not usually good.

4. A poor queen will often go out of her road to lay drone eggs in the corner of some comb.

5. Old queens are shiny-looking about the abdomen, and appear stiff and slow in their movements.

6. Drones in worker-cells are an indication of a poor queen.

7. If the colony has available stores and only a small quantity of brood the queen may be held responsible.

8. When the bees are evident loafers it is often the fault of the queen.

Queens which are observed to be faulty in the above respects should be disposed of and a young queen installed in the place of each.

HOW TO TELL A GOOD QUEEN.

The essential qualities in a good queen are the reverse of the above. She will lay her eggs regularly in circles, commencing in the middle of a comb and working outward, so that as each comb of eggs develops it will present a regular appearance. She will fill each side of the comb with a solid mass of brood, leaving only the edges free for pollen-storing, and possibly the outer sides of the two outside combs. Her eggs will be placed evenly, all pointing in the one direction, and only one in each cell. Any bits of drone-comb will be left until the season is well advanced before eggs are laid in them. Her progeny will be gentle but hardy and enduring workers, industrious at all times.

THE FARM GARDEN.

W. H. TAYLOR.

VEGETABLE-CULTURE.

THE present is an important time in vegetable-culture. Much depends on first steps. The successful management of a garden is by no means the simple matter it at first appears to be. No one knows this so well as those who have "been through the

mill"—having had to provide a constant supply when conditions were not of the best, and experience had yet to be gained. It is not economy to grow similar crops repeatedly on the same ground, yet there are exceptions when it may be wise to do so. Onions, for instance, can be grown repeatedly on the same spot, and always succeed. This crop appears not to rob the soil of anything that cannot be easily returned. It does not poison the soil for itself, as some plants do, such as tomatoes, which should not be grown more than twice in the same place. It may be advisable to repeatedly grow onions in the same place, but this depends on the general conditions of the soil in the garden, onions requiring a good bed. If the conditions are the same all over there will be no need for this procedure.

Some vegetables prepare the soil for others. Broccoli and Brussels sprouts are usually heavily manured, and so following them peas do well with little manurial addition, except a little artificial fertilizer. Where celery has been properly grown the very best of parsnips can be grown with no manure of any kind. Root crops, such as parsnips, carrots, and red beet should be grown in soil that was well manured the previous season for some other crop, or should be manured with artificial fertilizers only and no fresh animal manure. Fresh manure grows coarse roots, causing them to fork and throw out hair-like roots from the sides, resulting altogether in poor quality.

Broccoli and *Brussels sprouts* do best on firm ground. If a green crop of any weight is turned in on ground to be planted with these vegetables, it should be done in time to allow the green matter to decay and the soil to get settled down. If the soil is too spongy, as it well may be if green matter is turned in not long before planting, the plants are likely to make flimsy growth. They may be large, but unsubstantial. In such case sprouts would spread and be leafy instead of being little solid balls. Broccoli might fail to button, or be very small. Where soil is not firm it is a good plan to plant without breaking it up. Hoe up weeds and the remnant of the previous crop, and plant on that surface. In England it is quite common to plant in that way, a crow-bar being frequently used to make the holes.

A little scheming will economize space. *Radishes* and *spinach*, being quick crops, do not require space of their own. Grow them between other crops. Summer spinach sown between rows of French beans at the time they are sown would be done with before the beans would require the space, or it may be sown between rows of newly planted cabbages or cauliflowers. Thus the only cost in labour would be sowing the seed. If rows are planted to run north and south, tall-growing subjects, such as

Jerusalem artichokes, peas, and broad beans, can be alternated with low-growing crops, only allowing distances apart as for the dwarfs. Much space and labour can be saved in this way. The mode of procedure would be thus: Suppose half a dozen rows of carrots are wanted, sow these in contiguous lines; then sow a row of tall stuff, following with a dwarf variety. This was my constant practice for years, and it answered perfectly.

Potatoes.—The difficulty about good seed is a perennial one, and questions thereon are numerous. Some complain about sets not growing. The danger of planting such sets would be obviated if the seed were sprouted before planting, but this method would not make good seed out of bad. I find many think that good table-potatoes are the best seed, and so buy such in the open market or take some from their own stock. The idea is quite wrong. Tubers that were thoroughly ripe when dug may never sprout, as the skin becomes too dry and hard. Seed should be selected from crops about two-thirds grown, while the haulm is still fresh and green—just in the state, in fact, in which early potatoes would be dug for use. To secure the best seed, selection should be made of the healthiest-looking roots, digging these from all over the patch. It is more important to get the best of seed for the early than for the later planting, when the soil has more forcing-power. It was a matter of necessity with me for some years to save seed from early crops for planting the following season. My crops were dug in December and January. Seed to be kept was left in the sun to green, and then stored thinly on an airy shelf with plenty of light. They always kept till the end of August, when they were planted. They yielded good crops, generally from twenty to twenty-six table-potatoes per root. It is interesting to find that this plan is now advocated by the highest authorities

Current Work.—Leek seed should be already in the ground. In the colder parts of the Dominion October is late enough to sow all the *broccoli*. A selection of early, mid-season, and late varieties will prolong the season. In warmer parts seed can be sown in November. I am not, however, aware that there is any real advantage in doing so, unless it be convenience. My impression is that they come at the same time as they would if sown earlier, but would be smaller. In all but the warmest places broccoli should be planted out before the end of January, or they may fail to button till the following year. *Brussels sprouts* should be sown at once if this is not yet done. Never let the plants crowd each other in the seed-bed; good growing all the time and a long season of growth gives good sprouts. Sow *Savoy*

at the end of the month. Sow in succession *peas* and *French beans*, and also *runner beans*. The latter do best in trenches prepared as for celery. *Turnips* should be sown at intervals of eight weeks during summer. The plan is to sow a new lot when beginning to pull the last sown. Sow *lettuce* thinly in rows, and thin out. This method is better than transplanting in summer. *Pumpkins*, *marrows*, hardy *cucumbers*, *pie-melons*, and *rock-melons* may be sown in the open ground early in November in all situations, and a little earlier in the warmer parts of the Dominion. If the soil is good no special preparation is needed. Moisture is the thing required rather than richness of soil.

THE HEMP INDUSTRY.

W. H. FERRIS.

THE output of phormium-fibre for August showed a good increase, exceeding the quantity recorded for that month for many years past. The greater part of the hemp which passed through the grading-stores, however, was anything but satisfactory, this being due, no doubt, to the fact that the lines were largely composed of hemp damaged during recent adverse climatic conditions. Another reason may have been that there is now only £1 a ton difference in market value between low-point good-fair and high-point fair parcels. It is a matter for regret that inferior quality should apparently be aimed at, especially as there is undoubtedly a fair profit in the ruling values of the higher grade. There may be a little saving in turning out lower quality by rushing the milling processes, but the practice is distinctly bad for the industry, especially at a time when there is an opportunity to introduce the higher grades to the notice of oversea manufacturers, and when, also, it is a comparatively easy matter to secure the better quality by reason of the leaf available being healthy and sound generally. It must be mentioned, however, that a fair number of millers have continued to produce good-quality fibre throughout.

Most of the mills throughout the Dominion have now resumed operations, and the output for the season promises to show a substantial increase on last year's working. A very good demand has set in for tow, and prices offering for this by-product are decidedly profitable; a satisfactory standard is being maintained by the mills.

A very large proportion of the hemp-output is still being shipped to Australia to supply the demand for binder-twine purposes.

ANSWERS TO CORRESPONDENTS.

CORRESPONDENTS are requested, when desiring information through the Journal in regard to disease in animals and plants, to forward, where possible, affected specimens, in order to facilitate a correct diagnosis of the trouble and to ensure the best advice. In stating a question the most complete descriptive details should be furnished.

Correspondents desiring information in regard to manurial treatment of soil are requested to fill in and forward the prescribed form—"Application for Advice as to Manurial Treatment of Soil"—obtainable from any office of the Department in the Dominion.

In every instance a question to which an answer is desired in these columns must be accompanied by the full name of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written only on one side of the paper.

DESTRUCTION OF HARES.

ARTHUR VINCENT, Westport :—

Hares have been very destructive this season, barking young trees and chewing young barley down to the ground. What is the best method of destroying them ?

The Fields Division :—

To prevent hares barking young trees a suitable method is to twine around the trunk of the tree a strip of tarred sacking. To save the barley, netting-in the area or shooting the invaders would be the only feasible methods. If the netting were erected, of course the sacking on the trees would not be required.

POISONING SEED.

"POISONER," Palmerston North :—

Do you know of any means of poisoning grass-seed for surface sowing without destroying the germination of the seed too much ? My trouble is that the birds destroy every bit of seed I sow, and even if I did not poison the birds I might make the seed distasteful to them.

The Fields Division :—

To our knowledge there is no feasible means of treating grass-seed to prevent birds from eating it without destroying the germination. Grain or large seeds generally could be treated with a thin paste made with red-lead and water. This would poison birds without interfering seriously, if at all, with germination. Grass-seed, however, is too delicate to be so treated.

SHEEP WITH EAR-GROWTHS.

"INQUIRER," Canterbury :—

I have one or two sheep with growths on their ears. Should their flesh be fed to dogs ? Also, should their skins be saved ?

The Live-stock Division :—

If the growths on the ears are all that is the matter with the sheep there is no likelihood of the flesh being harmful if fed to dogs, nor that the skins should not be marketable. It is the wisest plan, however, to burn or bury all carcases of ailing sheep.

LICE AFFECTING COWS.

K. M., Kekerangu :—

What is a simple and reliable remedy for lice on cows? Owing to the certainty of the cows licking themselves I do not wish to experiment with any wash that might be injurious to them.

The Live-stock Division :—

As you remark, the habit cattle have of licking themselves and their neighbours prevents the employment of poisonous substances which can be effectively used for non-licking animals. Possibly kerosene in the form of an emulsion would be the safest. This is made by adding 1 lb. of soft-soap or good bar-soap to a gallon of soft water and allowing to simmer over a slow fire until the soap is dissolved; then remove from fire and add a half-pint of kerosene, stirring until it becomes a creamy consistency. Apply with a stiff brush. It may be necessary to apply again in eight days' time to kill any lice that have hatched out since the first dressing. Another dressing is composed of potassium sulphurata (liver of sulphur) 4 oz., water 1 gallon.

BIRDS IN ORCHARD.

G. H., Tira Ora :—

Is there any practical method of destroying bird pests in orchards? In the season for cherries particularly, thrushes, blackbirds, and wax-eyes come in swarms. There is shelter bush surrounding the orchard which gives them good cover. They literally skin the trees between them.

The Horticulture Division :—

Birds can be checked to a certain extent by laying baits in the form of ripe apples or pears treated with strychnine, but the only satisfactory means of protecting cherries is to put a framework around the trees and cover them with fine-mesh netting.

ABORTION IN COWS.

"DAIRYMAN," Kaipara :— —

I have a cow that has calved several weeks before her time. The calf is half ordinary size, but otherwise well and feeding. Have you known of such a thing? Is the calf worth keeping?

The Live-stock Division :—

The occurrence is not unusual, and providing you are willing to go to the trouble of looking after it the calf should do all right. You will find it will sleep most of the time until its proper date is due—about 285 days. In Earl Spencer's Shorthorn herd at Althorp, Northamptonshire, out of 764 observations it was found that no calf was born alive before the 220th day, nor after the 313th day, and that it was impossible to rear those born before the 242nd day.

LUCERNE-MANAGEMENT.

"INQUIRER" :—

I would like to know whether it hurts lucerne to cut it for seed. Would it be possible to get a cut before it is shut up for seed, or after it has been cut for seed? I would like you to inform me fully regarding saving lucerne for seed.

The Fields Division :—

It does not hurt lucerne to cut it periodically for seed if the soil is strong and generally well suited for growing the crop. On the lighter class of soils, however, the continuous cutting for seed would be inclined to reduce the productiveness of the crop. The second cutting of the season is usually kept for seed. When the seed can be rubbed out in the palm of the hand (the seed-pods need not necessarily be black) it is ready for cutting. The best machine for cutting lucerne for seed is the old-time reaper (tilter). It leaves the crop in such a position that the wind can get through it, yet it can be readily picked up. The cutting is allowed to lie until well dried, and then it is carefully lifted and stacked. Good weather-conditions are important in the curing and gathering of lucerne for seed purposes.

TREATMENT OF PASTURE, ETC.

"LUCERNE," Mangere :—

1. I have a paddock which was put down in grass late in the autumn, 1914, with 3 cwt. grass-manure, and has lately been top-dressed with 2 cwt. bones and super. The grass does not grow satisfactorily and is a poor colour. The soil is clay loam. What is the best treatment for it?

2. Is it possible to get the equivalent of farmyard manure in artificial manure at a reasonable price?

The Fields Division :—

1. Basic slag at the rate of 3 cwt. to 4 cwt. per acre would probably produce the desired effect, but this manure is not procurable at present. We would therefore advise your using lime. Top-dress with ½ ton per acre of burnt lime, or 1 ton per acre of finely ground limestone.

2. Farmyard manure is not a balanced manure, and requires reinforcing with some commercial fertilizer. It contains an excess of nitrogen, and is thus a manure that is out of proportion. Still, it contains what commercial fertilizers lack—humus. For these reasons it can hardly be contrasted with commercial fertilizers. Were you to practise systematically green-manuring as a source of humus, and to use commercial fertilizers, you may possibly be able to compare this cost with that of the farmyard manure and determine which would be the better and cheaper system. The two forms of manure for effective plant-growth are so interlocked that they are hardly comparable.

RABBITS ATTACKING TREES.

"POISONER," Palmerston North :—

Do you know of a mixture that one could inject into the bark of macrocarpa-trees to stop rabbits eating them?

The Horticulture Division :—

Rabbits are clean feeders, therefore coat parts of the trees likely to be affected with some mixture distasteful to them, such as lime-sulphur, oil and soot, or a mixture of soot, cow-dung, and lime, worked down with water.

FATTENING STOCK ON RAPE.

"REIDSDALE," Hastings :—

I have some three-year-old good store cattle, heifers and steers, on rape: will they fatten? If so, how long will it take to top them? Everything is in their favour—good climate, plenty of feed, rock salt, and good water. There are also a few acres of old grass in the paddock.

The Fields Division :—

We do not think the animals will fatten on the suggested feed although they may be kept growing in their store condition. At this time of the year rape must be practically over. Rape is grown as an annual plant, and its chief nutritive value lies in the young leaves and stems. Once seed-formation occurs the nutrient substances accumulated in the leaves and stalks are practically exhausted, the

whole plant becomes "woody" and more or less indigestible. When you see the leaves of the plant becoming a reddish-brown colour you may infer that its nutritive value is nearly over, and there is risk, especially in the case of sheep, if they are fed on it. Numerous cases of mortality in sheep fed on rape in this condition have been noted, and it is a question whether the deaths are due to indigestion owing to the woody nature of the plant or to some deleterious substance generated in it at this period of its growth. This condition might very well take place in cattle if they were fed on rape in a similar condition.

CORRIEDALE SHEEP.

JAMES O. ANSTISS :—

What is the right method of breeding to produce Corriedale sheep ?

The Live-stock Division :—

Corriedales originated by mating the Merino with either the Lincoln or Leicester—generally, but not invariably, the Merino ewe to long-woolled ram—both sides being studs of highest order. From the half-bred it is a matter of selection to type, a process demanding great skill and judgment.

SOIL-INOCULATION FOR LUCERNE.

FRED ESCREET, Norsewood :—

Would soil taken from a lucerne-paddock that was only laid down last December be any use for inoculating a patch for sowing with lucerne this spring ? There are a nice lot of nodules on the roots now, and the lucerne is looking very promising.

The Fields Division :—

If the lucerne is promising and the nodules are there the soil will contain the bacteria necessary for inoculating soil elsewhere.

POTATO-GROWING.

"INQUIRER," Tokomaru :—

I have a few acres of ground I intend putting in with potatoes about the middle of October or later. The nature of the soil is fairly heavy clayey loam, with a heavy clay subsoil with mixture of ironstone. I have recently had it ploughed up about 6 in. deep from lea, and it is a little wet, but it is well drained by mole drains 8 ft. apart. Would you inform me what would be the best way to work it so as to keep the grass down and ensure a suitable tilth ? What manures and quantities per acre would I require in this soil ?

The Fields Division :—

When the soil is sufficiently dry, roll down the furrows with the light roller. Disk, cultivate, and harrow as required. Before planting, cross-plough. This is generally advisable in planting potatoes out of lea. Harrow and cultivate again. The spring-tooth cultivator may be used after the second ploughing. On your heavy soil it would be advisable to throw the land into ridges with the ridging-plough, making the ridges 30 in. to 35 in. apart. Apply in the drill a mixture of superphosphate 4 parts and blood-and-bone manure 2 parts, in quantity up to 6 cwt. per acre. Plant sets over this distance at from 18 in. to 24 in. in the row, according as the variety you use has less or more haulm-growth ; then split back the ridges.

TROUBLE WITH EWES.

"A. B.," Tahuna :—

I had some trouble with in-lamb ewes that had a red inflamed ball protruding behind. I was told if it was bathed in warm water with antiseptic and then covered with sweet oil, after lifting the ball up and letting the water pass away, I could return it to its place and tie the wool across the vent, and the sheep would recover. It was a failure. When this has occurred since, I killed the sheep and

boiled them for the pigs. What is the cause of this, and is there any practical remedy? Is it contagious?

The Live-stock Division:—

The predisposing cause of extrusion of the vagina in in-lamb ewes is having the ewes too fat and without sufficient exercise during the last period of parturition. You will find all particulars in the Department's bulletin, "Two Diseases affecting Pregnant Ewes," a copy of which has been forwarded you.

SUITABLE POTATO FOR LIGHT PUMICE LAND.

"RUHAMAH," Wanganui:—

What is the best potato (early and late) to sow in light pumice soil? I have tried Up-to-Date twice without success.

The Fields Division:—

For light pumice land Coronation is recommended as the best early variety, and Supreme as the best late variety.

TROUBLE WITH COW'S TEAT.

J. R. G., Halswell:—

We have a cow (calved a week) which is giving some trouble with a teat. Just where the teat joins the udder and on the inside there is a small but fairly hard lump, which blocks completely the flow of milk. By pushing a small silver tube up the passage in the teat and through this lump I can get a flow of good milk, but even after making a passage by this process I cannot get a flow by milking in the ordinary way. The tube goes through the lump easily enough as a rule, but, of course, it irritates the cow to a certain extent, and, in addition, does not seem to improve the teat, as I have to repeat the process on every occasion that the cow is milked. Would you kindly let me know if there is any remedy for keeping the passage open, thus making the teat sound?

The Live-stock Division:—

The obstruction is evidently a warty growth from the mucous membrane lining the teat. I am afraid that all you can do is to draw off the milk with the teat-siphon as you are doing. Without the tube is kept thoroughly clean and aseptic by boiling before each insertion the cow is likely to get inflammation of the quarter. This may occur, too, even if the tube is clean, owing to irritation of the growth. I do not know of anything that would keep the passage open. The only treatment is to cut into the teat and excise the growth. This can only be done when the cow is dry. If it were done now the result would be that the operation-wound would not heal, and the milk would escape through it.

CARROT-GROWING.

"ONETOKO," Tokomaru Bay:—

What is the best carrot to grow for horse-feed, and when are the right times to sow carrots so as to have a plentiful supply during winter and also during the summer months? Kindly furnish instructions in lifting and storing.

The Fields Division:—

Two varieties of carrots highly suitable for horse-feed are White Belgian and Giant Orange. Sown in spring (August to September), early summer (early in November), or early autumn (February to March) in your district, you should have a continuous supply during summer, autumn, and winter. Carrots are usually loosened for lifting by running a single-furrow plough with mouldboard removed on either side of the drill. They are then pulled by hand and topped with a sharp knife. The use of a deep three-pronged fork facilitates pulling. They are stored much the same as potatoes, in pits. They are piled in heaps about 5 ft. wide,

with the top ends outwards. Dry sand may be intermixed to advantage with the carrots. The pile is covered with dry straw, and this is surmounted with a goodly layer of earth. Provision should be made for ventilation. A pipe the mouth of which is protected from the rain would be suitable for this purpose. A trench should be cut around the pit to promote drainage. In growing carrots deep cultivation and a finely divided seed-bed are essential.

A DISINFECTANT WHITEWASH.

"NEW CHUM," Thames :—

What is the most suitable whitewash disinfectant mixture for spraying milking-sheds, fowlhouses, &c. ?

The Live-stock Division :—

The following wash is perhaps as good as anything, and is applicable for both outside and inside use: Take ½ bushel unslaked lime, slake with boiling water, and cover to keep in the steam. When cool strain through a fine sieve. Add 1 peck common salt with enough warm water to dissolve it, 3 lb. ground rice boiled to a thin paste and stirred in while hot, ½ lb. Spanish whiting, and 1 lb. glue previously dissolved by soaking in cold water and then melted in a water-bath. Then add 5 gallons of warm water (in which a pint of pure carbolic acid per gallon has been added, if for inside work) and allow it to stand a few days before using, well covered from dust. Before applying it, as much as possible of the old limewash should be scraped off.

SWEDES AND CROP-ROTATION.

"MATAMATA" :—

I have been told that swedes will not grow so well after a green crop, such as barley or rye ploughed in, as after grass: is that so ? I had meant to follow out the following rotation: First year, ryecorn sown for seed and ploughed in, say, in October; second year, swedes; third year, part rape and part turnips and grass in autumn; fourth year, grass; fifth year, grass. Please let me know if you take exception to this.

The Fields Division :—

If the ryecorn followed pasture as in the suggested rotation the crop of swedes ought to be as good as if it followed grass, provided the rye was matured and was eaten down bare and the soil is not puddled in doing so. There is always, however, a danger in following one crop with another at close intervals—that the first crop leaves the ground too dry for the second—a condition which is aggravated if much growth is turned under. Any bulky stuff turned under acts as a mulch in preventing the rise of moisture from the subsoil to the surface until it has rotted and becomes properly incorporated with the soil. Otherwise no exception can be taken to your rotation. It is well designed from the fertility point of view, and if phosphatic manures are freely used, with a fair proportion of clovers in your seeding-down mixtures, good crops and vigorous grass should result.

WHITE LUPIN.

"SUBSCRIBER," Tauranga :—

I propose growing some white lupin for seed. What time is it best to sow, and how far apart should the rows be ? Can the crop be harvested with a binder and threshed by machine, or would it have to be picked and shelled by hand ?

The Fields Division :—

Sow in spring when all danger of frost is past—September onwards. The rows should be 14 in. apart. If seeded at this distance at the rate of 100 lb. per acre, the crop can be harvested by a reaper-and-binder. If the growth should be exceptionally strong, a reaper with a tilting attachment could be used. Cut when the seed is sufficiently hard. The crop could be threshed with an ordinary threshing plant.

WOOL EXHIBITS IN NEW ZEALAND COURT, PALACE OF AGRICULTURE, PANAMÁ PACIFIC EXHIBITION.

COMMERCIAL INTELLIGENCE.

THE NORTH AMERICAN WHEAT CROP.

THE New Zealand Trade Commissioner at San Francisco, Mr. E. Clifton, writes under date 20th July last as follows :—

"It is estimated that in Canada there are this season 12,896,000 acres in wheat, nearly 2,600,000 acres more than the area harvested in 1914. Last year there was a considerable diminution of the total area, owing to the drought affecting the spring wheat and the winter killing part of that sown in the autumn. This year's area is stated to be the largest ever sown in wheat in Canada. The increase has been brought about to a great extent by patriotism and through the high prices that were realized last year. At the present time there is an assurance that the crops throughout will be higher than the usual average. All indications point to an even greater yield than was anticipated earlier in the season, and the hopes of the farmers throughout the big Dominion are high.

"The estimate of the United States wheat crop as given in the official Monthly Crop Report of the 15th July is 59,417,000 acres. So far as condition is concerned, taking 100 as the standard, the estimate on the 1st July was 87. The estimated average yield was 16·2 bushels per acre, or a total of 963,000,000 bushels."

[An Ottawa cablegram, dated 16th September, gives the official estimate of Canada's exportable surplus of wheat as 200 million bushels.—ED.]

THE ANNUAL SHEEP RETURNS.

THE complete sheep returns for 1915 show the sheep in the Dominion on the 30th April last as 24,824,394, which is the greatest number yet recorded. The North Island returned 13,309,982 (increase 154,024), and the South Island 11,514,412 (decrease 128,393), leaving a net increase for the Dominion of 25,631 as compared with the previous year. The flock sheep number 24,079,573, divided into crossbreds and other longwools 22,849,385, and Merinos 1,230,188. Stud sheep and flock rams number 744,821, the different breeds in this total being represented as follows: Lincoln, 96,997; Romney, 328,410; Border Leicester, 81,912; English Leicester, 65,801; Shropshire, 16,025; Southdown, 54,297; Merino, 51,476; other breeds, 49,903. Compared with 1914 breeding-ewes show a net decrease of 341,311 (North Island increase 21,189, South Island decrease 362,500). The number of sheepowners is returned as 22,680, an increase of 478, in which all the sheep districts share except Otago, which shows a decrease. Other details of the returns are set out in the tables printed on page 278.

NEW ZEALAND PEARS AT SAN FRANCISCO.

REPORTING on a consignment of fifty-four cases of Winter Nelis pears shipped through the Department to San Francisco in June last, the New Zealand Trade Commissioner, writes :—

"The consignment of fifty-four cases Winter Nelis pears arrived here in good order and condition, opening up, in fact, better than any of the previous fruit shipments sent from New Zealand to the Exhibition. It was only necessary to remove a few fruits here and there, and the total wastage did not amount to more than one case. Where wastage occurred it was due to the presence of a wet rot. Messrs. Wetmore Bros., who have handled all the fruit shipments sent to my care, are very pleased with the quality of this pear as being of good flavour and texture. They state that if the fruit can be landed here in April, May, and possibly the

early part of June, it will sell to advantage, but after that time the local market is crowded with local new season's fruit, including pears, with which it has to compete."

The amount realized for the whole shipment was $96·15, an average of $1·78 per case.

AMERICA AND THE EGG TRADE.

It is reported that several of the largest bakers' supply-houses of the United States contemplate erecting factories and drying plants in China to manufacture dried and desiccated eggs. One plant has already been established near Hankow, and another is to be erected at Shanghai, with a branch at Tientsin. It is intended to pack the product in handy-sized tins, and several grades of eggs will be marketed. During 1914, 3,600,000 dozen eggs were shipped from Shanghai to American Pacific coast States; their value was $540,000, equivalent to 15 cents per dozen. The ordinary freight rate from China to Pacific coast ports per regular lines is $8 per ton (seventeen cases of eggs to the ton, making a rate of approximately 1·6 cents per dozen). Refrigerator space costs $16 a ton. The United States duty of 5 cents per dozen on fresh eggs was removed by the Tariff Act of 1913, while the duty was reduced on other eggs as follows, the former rate being given in parentheses: Eggs, dried, 10 cents (15) per pound; yolks, 10 per cent. (25); frozen, 1 cent per pound (formerly 5 cents per dozen, based on eleven eggs to a pound).

FRANCE AND FROZEN MEAT IN THE WAR.

Under the title of "The Agricultural Effort of France during Six Months of War—August, 1914, to January, 1915," the French Department of Agriculture issued a report concerning its special activities during the particularly strenuous period indicated. From a summarized translation of the report in the *Monthly Bulletin of Economic and Social Intelligence*, published by the International Institute of Agriculture, the following reference to frozen meat is extracted. The incidents will add a chapter of historic interest to the annals of the frozen-meat trade. The report states:—

The plan for victualling the civil population in entrenched camps as well as the army, as was foreseen, necessitated the putting of all the cattle of the nation under contribution. In all the departments committees were appointed to buy or, if needful, to requisition the cattle, which had to be collected immediately in enclosures, thence to be gradually distributed according to need. Thus for the camp at Paris a considerable herd had been collected and divided among a large number of enclosures round the city.

Besides the difficulty of establishing such depots, this plan has others of a serious nature. For instance, thousands of cattle cannot be enclosed in a limited space, for should panics arise among them the frantic animals throw down the strongest barriers. Therefore these enclosures present great difficulties in regard to their arrangement. The flocks and herds must come on foot to the enclosures, and must be brought on foot to the troops whose needs they are to serve. Animals of improved breeds—and few others are now raised in France—are not adapted for long journeys on foot; and their crowding of the roads along which they must pass is an obstacle and often a peril for marching columns and the movement of convoys.

Another very serious difficulty exists in the danger of contagious diseases when so many animals are assembled together, and also of diseases due to overcrowding, the more to be feared as they cannot be avoided, in spite of all efforts of the sanitary authorities. From an economic point of view it is plain that the requisition of a great number of animals must leave certain regions unprovided. When these levies are carried out in the north and west they fall most heavily on dairy and young cattle, while in regions rich in butchers' beasts ready for sale no requisition is made. Happily, circumstances allowed of some attenuation of the greatest difficulties. The full supply of the camp at Paris could be adjourned and the proposed stock considerably reduced. Also, the contribution demanded from the nation could be diminished by the importation of frozen meat from abroad.

The economic policy of France up to the present time had been formally opposed to the introduction of frozen meat, and a double barrier in Customs duties and sanitary restrictions, almost insurmountable, had existed. The Minister of Agriculture, by a decree of the 2nd August, 1914, suppressed the rules of a technical nature (obligation to cut up in quarters with adherence of the pluck to one of the fore quarters) which in fact prevented the entrance of such meat, and obtained from the Minister of Finance, by decree of the same date, the suppression of the duty of 35 francs on every 100 kilograms, the minimum tariff on such imported meat. Under this new regulation importers are under no obligation except that of the sanitary inspection to which all meat, whether fresh or preserved, is subjected on entering the Republic.

The War Department had allowed some orders for frozen meat by way or trial, and early in September some thousands of tons arrived at Bordeaux and Marseilles. But, for fear that it could not be used quickly enough before danger of being spoiled, an offer was made to the victualling commission of Bordeaux for the civil population established there of as much of this meat at market price as it could induce the butchers of the town to buy. This offer was immediately accepted, and, as some doubts existed as to the reception of the meat by the civil population, a trial was made at Bordeaux in connection with the butchers' syndicate. This was conclusive. The butchers declared themselves ready to buy as much of this meat as they could get. The price had been fixed sufficiently below that of the home-produced meat to ensure its sale. This frozen meat had all to bear indication of its origin, and thus fetched a slightly lower price.

The War Department continued its trial of the frozen meat with the troops, and the result very soon proved most satisfactory. The frozen beef arrives in quarters packed in the holds of vessels provided with refrigerators, each quarter weighing from 70 to 80 kilograms. Each is closely wrapped in muslin, with packing-cloth over it. The meat is excellent and equal in quality throughout. The quarters, taken out of the cold-storage compartments by sliding panels, are at once piled in wagons ranged along the quay. The straw at the bottom and sides of every wagon is sufficient protection to isolate it. The wagons being thus packed, the time required for each to reach its destination is specified: three days at least in warm weather, and five at least when the temperature is not above 15° (centigrade).

This success soon induced the Department not only to replenish the depots with frozen meat, but also to send some to the front, where the soldiers so highly appreciated it that it was decided that all ship-loads already arrived or about to arrive should be reserved exclusively for the army, and contracts were also made for a supply of 15,000 tons per month, beginning from the 1st January, 1915.

The advantages of frozen meat are easily seen. It may be transported from place to place without special precautions, packed in wagons or carts in easily handled quarters, well protected against external soiling. It is of best quality, not over fat, and perfectly healthy. It has all the qualities of fresh meat when eaten at the proper time—that is, cooled and kept the necessary time; it is much more tender than meat still warm after slaughter. It is, besides, incomparably superior to that furnished by cattle, tired and often ill, following troops; also infinitely superior to the flesh of requisitioned cattle.

Taken altogether, the calculations of the agricultural administration lead to the belief that the quantity of frozen meat consumed in the first six months of 1915 may be estimated at 150,000 tons, purchased partly by the War Department, partly by private persons. The meat will be principally beef, representing about 450,000 head of cattle, almost half of what is required weekly in ordinary times. We see that this imported meat will tend to the saving of the home cattle to an unexpected extent.

Cabling on 11th September the High Commissioner, London, reported that wheat crops all over the world promised well, and that the European crop was estimated at about 30,000,000 quarters more than last year.

A cable report dated the 23rd June, 1915, from the International Institute of Agriculture at Rome to the United States Department of Agriculture, forecasted the 1915 harvest of winter wheat in European Russia as 301,508,000 bushels, an increase over last year of 40·3 per cent. The figures refer apparently to all European Russia except Poland.

SHEEP IN NEW ZEALAND.

SHEEP IN RESPECTIVE SHEEP DISTRICTS AS AT 30TH APRIL, 1915.

—	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago (including Southland).	Total in Dominion.
Stud rams	664	3,149	4,816	1,141	3,593	2,703	16,066
Flock rams	19,260	71,423	72,817	15,291	65,702	53,902	298,395
Wethers	263,982	664,540	810,845	191,405	590,275	737,431	3,258,478
Breeding-ewes	839,086	2,824,245	2,977,236	678,156	2,885,322	2,374,780	12,578,825
Dry ewes	68,725	351,336	283,957	57,052	328,283	289,924	1,379,277
Lambs	487,207	1,833,544	1,733,150	401,225	1,468,114	1,370,113	7,293,353
Totals, 1915	1,678,924	5,748,237	5,882,821	1,344,270	5,341,289	4,828,853	24,824,394
Totals, 1914	1,475,068	5,787,907	5,892,983	1,304,639	5,557,130	4,781,036	24,798,763

SHEEP IN THE DOMINION: TEN YEARS, 1906–15.

Year (30th April).	Stud and Flock Rams.	Stud Breeding-ewes.	Stud Dry Ewes.	Stud Lambs.	Total Stud Sheep and Flock Rams.	Flock Sheep.				Grand Total, Stud and Flock Sheep.
						Wethers.	Breeding-ewes.	Dry Ewes.	Lambs.	
1906	241,927	206,612	11,105	141,319	600,963	2,788,900	10,272,575	921,629	5,524,404	20,108,471
1907	255,502	215,528	12,773	151,881	635,684	2,899,763	10,521,318	982,229	5,944,778	20,983,772
1908	272,752	230,075	14,725	157,556	675,108	3,378,398	11,013,966	1,152,120	6,229,461	22,449,053
1909	298,918	222,799	14,192	153,948	689,857	3,427,994	12,147,547	1,001,067	6,214,242	23,480,707
1910	305,569	227,187	13,943	160,234	706,933	3,167,082	12,288,193	1,194,570	6,912,842	24,269,620
1911	297,898	229,709	14,117	163,899	705,617	3,342,281	12,094,754	1,298,343	6,555,125	23,996,126
1912	306,588	232,782	11,563	155,498	706,431	3,359,969	12,044,247	1,324,200	6,315,306	23,750,153
1913	313,690	228,145	12,902	167,605	722,342	3,207,550	12,292,891	1,150,805	6,818,222	24,191,810
1914	321,869	229,055	13,526	170,169	734,619	3,211,661	12,691,121	1,152,749	7,008,613	24,798,763
1915	314,461	237,201	17,298	175,861	744,821	3,258,478	12,341,624	1,361,979	7,117,492	24,824,394

THE DOMINION'S EXPORTS TO BRITAIN.

COMPILED FROM MANIFESTS OF VESSELS SAILED DURING RESPECTIVE MONTHS OF CURRENT AND PRECEDING SEASONS.

Month.		Mutton, Carcases.	Lamb, Carcases.	Beef, Quarters.	Pork, Carcases.	Butter, Boxes.	Cheese, Crates.	Wool, Bales.	Wheat, Sacks.	Oats, Sacks.	Rabbits, Crates.	Hemp, Bales.	Tow, Bales.	Kauri-gum, Cases.
January,	1915	137,816	296,439	45,622	339	138,081	85,123	87,393	..	..	2,860	683	..	1,209
,,	*1914*	*231,766*	*464,185*	*30,424*	*33*	*150,492*	*136,086*	*108,742*	..	*500*	*2,851*	*15,234*	*4,306*	*11,133*
February,	1915	433,585	517,581	77,421	311	119,371	96,090	159,347	..	..	..	13,111	6,619	2,763
,,	*1914*	*354,190*	*334,207*	*14,100*	*3*	*86,570*	*59,532*	*127,372*	..	*4*	..	*3,709*	*633*	*7,607*
March,	1915	80,439	203,480	30,176	..	55,280	51,811	49,809	..	..	..	8,410	185	274
,,	*1914*	*446,522*	*551,313*	*36,689*	..	*61,060*	*62,732*	*95,175*	..	..	..	*8,187*	*2,562*	*3,958*
April,	1915	286,155	328,779	45,340	..	6,703	38,561	41,371	..	..	1,011	9,328	1,474	3,461
,,	*1914*	*234,765*	*366,786*	*22,185*	..	*7,822*	*63,796*	*58,488*	..	*2,901*	..	*1,247*	*888*	*5,909*
May,	1915	257,953	433,831	34,780	655	148	17,065	21,615	..	..	2,923	4,968	808	2,636
,,	*1914*	*336,632*	*638,397*	*39,315*	*54*	*837*	*37,776*	*43,364*	*3,623*	*11,062*	..	*8,355*	*2,112*	*9,316*
June,	1915	99,080	154,785	19,316	932	..	26,869	11,946	..	..	9,800	5,027	1,320	1,229
,,	*1914*	*261,877*	*634,981*	*36,400*	..	*1,153*	*19,247*	*18,774*	..	*28,141*	*1,000*	*7,924*	*4,258*	*7,881*
July,	1915	243,420	340,476	21,231	154	..	21,520	16,039	..	..	5,968	5,068	1,639	4,184
,,	*1914*	*225,411*	*239,143*	*38,170*	..	*1,355*	*2,003*	*15,868*	..	*1,425*	*1,000*	*5,810*	*2,584*	*8,053*
August,	1915	510,418	570,381	51,750	35	..	18,287	19,416	..	..	31,790	7,138	1,466	4,848
,,	*1914*	*84,251*	*63,111*	*19,094*	*516*	*1,979*	*50*	*4,845*	*600*	*38,220*	*10,403*	*367*	*245*	*3,705*
September,	1914	53,386	49,200	2,353	..	15,885	..	3,337	..	5,896	7,288	1,143	57	..
,,	*1913*	*133,122*	*83,521*	*5,334*	*16*	*6,575*	*2,020*	*7,176*	..	..	*16,336*	*3,826*	*1,501*	*10,049*
October,	1914	291,432	128,016	49,104	..	81,842	30,487	8,938	..	68,660	38,121	2,042	1,650	1,683
,,	*1913*	*14,122*	*25,735*	*580*	..	*42,847*	*21,452*	*2,705*	..	..	*10,020*	*6,986*	*3,672*	*2,923*
November,	1914	136,346	27,577	48,302	27	98,729	70,048	37,604	15	24,289	35,783	885	110	1,377
,,	*1913*	*20*	*1,479*	..	..	*53,468*	*23,722*	*1,891*	..	..	*2,478*	*4,162*	*771*	*2,314*
December,	1914	192,952	149,835	44,876	..	172,990	80,114	86,317	..	..	9,306	1,136	116	2,157
,,	*1913*	*128,087*	*86,890*	*8,909*	..	*249,526*	*124,821*	*51,385*	..	*250*	*24,479*	*19,807*	*5,276*	*11,273*

LONDON MARKET VALUES.

COMPARATIVE STATEMENT COMPILED FROM THE HIGH COMMISSIONER'S CABLES FOR THE PAST THREE MONTHS.

London Date.	Wool. Bradford Quotations for Tops. 36's.	40's.	44's.	50's.	56's.	60's.	Mutton. Canterbury.	Mutton. North Island.	Lamb. Canterbury.	Lamb. Other than Canterbury.	Beef. New Zealand Hinds.	Beef. New Zealand Fores.	Butter. Danish.	Butter. New Zealand.	Cheese. New Zealand White.	Cheese. New Zealand Coloured.	Cheese. Canadian.	Hemp (Spot). New Zealand Good-fair.	Hemp (Spot). New Zealand Fair.	Hemp (Spot). Manila Fair Current.*	Hemp (Forward Shipment). New Zealand Good-fair.	Hemp (Forward Shipment). New Zealand Fair.	Hemp (Forward Shipment). Manila Fair Current.*	Wheat. Short-berried.	Wheat. Long-berried.	Oats. Sparrowbills.	Oats. Danish.
1915.							d.	d.	d.	d.	d.																
June 5	..	..	..	..	..	..	7	..	8¾	8¾	8	6¾	148/0	142/0	100/0	100/0	98/0	32/10/0	30/0/0	39/0/0	32/0/0	29/10/0	39/0/0	..	..	..	..
„ 12	2/1	2/2	2/3½	2/7½	2/9½	3/1	7	7	8⅜	8⅜	..	..	149/0	142/0	98/0	97/0	97/0	32/10/0	30/10/0	39/0/0	..	..	..	..	..	..	..
„ 19	..	..	..	..	..	..	7¼	7⅛	8⅜	8⅜	8	7	149/0	142/0	94/0	93/0	94/0	32/10/0	30/10/0	38/10/0	31/15/0	29/10/0	38/0/0	..	..	..	..
„ 26	..	..	..	..	..	..	7¼	7⅛	8⅜	8⅜	..	..	152/0	144/0	96/0	94/0	93/0	32/10/0	30/10/0	38/10/0	31/15/0	29/10/0	38/0/0	..	..	..	..
July 3	..	..	..	..	..	..	7¼	7⅛	8⅜	8⅜	..	..	154/0	146/0	94/0	93/0	90/0	32/0/0	30/0/0	38/10/0	31/10/0	29/10/0	36/10/0	..	..	35/0	..
„ 10	..	..	..	..	..	..	7¼	7⅛	8½	8⅜	7½	6¾	158/0	..	93/0	92/0	88/0	32/0/0	30/0/0	37/0/0	31/0/0	29/10/0	36/10/0	..	..	..	..
„ 17	..	..	..	..	..	..	7¼	7⅛	8½	8⅜	..	..	160/0	..	84/0	82/0	84/0	31/10/0	29/10/0	..	31/0/0	29/0/0	36/10/0	..	..	..	..
„ 24	..	..	..	..	..	..	7 3/16	7	8⅜	8 5/16	..	..	166/0	..	78/0	76/0	76/0	31/10/0	29/10/0	..	31/0/0	29/0/0	36/0/0	..	..	..	..
„ 31	..	..	..	..	..	..	7⅛	7	8⅜	8¼	7½	6¾	166/0	..	76/0	74/0	76/0	31/10/0	29/10/0	..	..	..	36/0/0	..	..	..	..
Aug. 7	..	..	..	..	..	..	..	6 13/16	8¼	8⅛	..	..	170/0	..	76/0	75/0	76/0	32/0/0	30/0/0	..	31/10/0	29/10/0	37/0/0	..	..	..	..
„ 14	..	..	..	..	..	..	7	6 13/16	8 3/16	8 1/16	..	..	170/0	..	76/0	75/0	76/0	32/10/0	30/10/0	..	32/0/0	30/0/0	38/0/0	..	..	..	..
„ 21	..	..	..	..	..	..	..	..	8⅛	8 1/16	..	..	169/0	..	75/0	74/0	75/0	32/10/0	30/10/0	..	32/10/0	30/10/0	38/0/0	..	..	..	..
„ 28	..	..	..	..	..	..	..	..	8⅛	8 1/16	7½	6½	165/0	..	73/0	72/0	74/0	32/0/0	30/0/0	..	32/0/0	30/0/0	38/0/0	..	..	..	..
Sept. 4	..	..	..	..	..	..	..	..	8⅛	8 1/16	..	..	168/0	..	75/0	74/0	76/0	32/0/0	30/0/0	..	32/0/0	30/0/0	38/10/0	..	..	..	..

* Quotations from 10th July are for Manila new grade "Fair."

HEMP AND TOW GRADING RETURNS.

AUGUST.

Hemp.—The total number of bales graded was 9,860, as compared with 5,003 for the corresponding month of last year, an increase of 4,857 bales. For the twelve months ending 31st August, 1915, the number of bales graded was 94,715, as compared with 126,319 for the previous twelve months, a decrease of 31,604 bales.

Tow.—During the month 2,758 bales were dealt with, as compared with 1,240 for the corresponding month of last year, an increase of 1,518 bales. For the twelve months ending 31st August, 1915, the number of bales graded was 25,271, as compared with 40,635 for the previous twelve months, a decrease of 15,364 bales.

Stripper-slips.—During the month the number of bales graded was 329, as compared with 71 for the corresponding month of last year. For the twelve months ending 31st August, 1915, the number of bales graded was 1,943, as compared with 3,388 for the previous twelve months, a decrease of 1,445 bales.

HEMP, TOW, AND STRIPPER-SLIPS GRADED THROUGHOUT THE DOMINION DURING THE MONTH OF AUGUST, 1915.

Hemp.

Port.	Superior.	Fine.	Good-fair.	Fair.		Common.	Rejected.	Con-demned.	Total.
				High Point.	Low Point.				
	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	..	71	361	663	150	56	6	1,307
Napier ..	..	..	..	..	..	..	..	..	..
Foxton ..	..	..	1,193	1,903	392	42	26	..	3,556
Wellington ..	..	..	845	2,905	360	41	58	2	4,211
Picton ..	..	96	16	..	62	..	..	..	174
Blenheim ..	..	..	193	60	..	..	..	..	253
Lyttelton ..	..	..	..	..	..	..	..	..	..
Dunedin ..	..	..	51	..	21	..	..	..	72
Bluff	..	..	45	210	32	..	..	..	287
Totals ..	..	96	2,414	5,439	1,530	233	140	8	9,860
Percentages of totals	..	0·98	24·48	55·16	15·52	2·36	1·42	0·08	..

Tow.

Port.	First Grade.	Second Grade.	Third Grade.	Condemned.	Total.
	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	71	356	119	546
Napier	..	..	..	..	..
Foxton ..	241	369	69	..	679
Wellington ..	293	593	53	14	953
Picton	..	65	..	..	65
Blenheim ..	66	85	..	..	151
Lyttelton ..	30	180	..	..	210
Dunedin ..	..	..	26	4	30
Bluff	..	24	99	1	124
Totals ..	630	1,387	603	138	2,758

Stripper-slips.—Foxton: First grade, 17; second grade, 66; condemned, 11. Wellington: Second grade, 132. Blenheim: Second grade, 74. Lyttelton: First grade, 29.

STOCK EXPORTED.

THE following table shows the numbers and descriptions of stock exported from the Dominion during the month of August, 1915:—

Port of Shipment.	Horses.			Sheep.			Cattle.		Pigs.		Dogs.		
	To Australia.	To Eastern Pacific.	To Montevideo.	To Australia.	To Eastern Pacific.	To South America.	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To United Kingdom.
Auckland ..	..	35	..	..	238	..	..	20	..	33	..	..	..
Gisborne ..	..	..	..	..	..	..	..	..	..	..	..	..	..
Napier ..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wellington ..	2	..	..	2	110	..	4	..	..	..	..	..	..
Lyttelton ..	2	..	..	100	6	..	..	..	..	..	..	..	..
Dunedin ..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bluff ..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals ..	4	35	..	102	354	..	4	20	..	33	..	..	..

Particulars of the horses shipped: One light-draught mare; 3 thoroughbred mares; 2 pony mares; 1 thoroughbred filly; 2 pony geldings; 30 cavalry remounts.

Twelve crates of poultry were also shipped from Auckland to the eastern Pacific.

STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of August, 1915:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
			MOTUIHI ISLAND (AUCKLAND).		
7	Shorthorn heifers	Females	Sydney ..	Dilworth Trust Estate	Auckland.
2	,, bulls	Males ..	,, ..	Ditto	,,
			SOMES ISLAND (WELLINGTON).		
1	Maltese terrier	Male ..	San Francisco	Mrs. Poynter ..	Hanson Street, Wellington.
3	Aberdeen bulls	Males ..	London ..	John Clark ..	Gisborne.
1	Collie bitch, and four pups	Female, mixed	Liverpool ..	New Zealand Express Company	Wellington.
1	Tamworth boar	Male ..	London ..	Mr. N. P. Nielson	Palmerston North.
			QUAIL ISLAND (LYTTELTON).		
2	Shorthorn bulls	Males ..	Sydney ..	L. Wilson ..	Teddington.
3	,, heifers	Females	,, ..	,, ..	,,
4	Guernsey heifers	,,	,, ..	,, ..	,,
2	Trotting fillies	,,	San Francisco	Freeman Holmes ..	Riccarton.
1	,, stallion	Male ..	Ditto ..	,, ..	,,
1	Pomeranian dog	,, ..	London ..	R. Bryttenden ..	Christchurch.
1	,,	Female	,, ..	,, ..	,,